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*Mudrost je znati šta činiti,
veština znati kako to da uradiš,
a vrlina je to zaista i učiniti.*

D. S. Džordan

Da biste sačuvali optimizam i volju za život u ovakvim vremenima, neophodno je da sebi neprestano postavljate sve više ciljeve. U vremenu svekolike i kulturne i naučne regresije to naravno nije ni lako, ni jednostavno. Čak ni u visokoškolskim ustanovama (a sinonim za univerzitet je sloboda) često niste u prilici da slobodno mislite i donosite odluke. Iako je osnov svake hrabrosti znanje, u životu je važno da sledimo svoje snove. Kada u našem srcu radost nadvlađa svu sumornost današnjeg trenutka i kada želja da rezultati našeg rada postanu pouka drugima, onda svako rešenje ima perspektivu.

Prošlu godinu je časopis „Stomatološki glasnik Srbije“ završio uspešno i na vreme. Štampane su četiri sveske sa dvadeset radova, od čega dvanaest radova domaćih autora i osam radova istraživača iz inostranstva. Saradnja s kompanijom *De Gruyter Open* već je dala pozitivne pomake vezane za bolju vidljivost časopisa, odnosno lakšu dostupnost zainteresovanim čitaocima širom sveta. Time je i citiranost autora koji objavljuju u ovom časopisu ove godine bila značajno povećana.

Iako su stručnost i znanje temeljni kriterijumi za uspeh, naporan rad je osnov svakog uspešnog ishoda. Međutim, ono što se najčešće zaboravlja jeste činjenica da su obrazovanje i učenje kontinuirani procesi koji se ne završavaju okončanjem školovanja. Tamo gde je samo probuđena nuda a očekivanja su izneverena obično nema ni rezultata. Tamo gde se znanje ne razdvaja jasno od nauke nastaju problemi (znanje se stiče i uči, a sumnja u znanje je nauka). Ako nemate slobodu da mislite i donosite odluke, vi postajete podanik i „krpa svakodnevice“. A svaki podanički odnos često gazi naučne principe i etiku i guši elementarno dostojanstvo.

I kao što reče uvek aktuelni Branislav Nušić, „sloboda je često fraza, a tiranija uvek istina“. Zato je važan onaj cilj s početka uredničkog komentara kojem treba neprestano stremiti. Treba takođe razumeti da ne postoje neuspesi u životu, već samo rezultati, da ne postoje problemi, već samo šanse koje treba prepoznati kao rešenja ukoliko imate dovoljno mudrosti.

Ovaj urednički komentar će završiti jednim pozitivnim citatom iz knjige Paula Koelja (*Maktub*) jer je to uistinu i najvažnija životna filozofija: „Što ste više spremni da pružite, više ćete dobiti za uzvrat.“

Prof. dr Slavoljub Živković

Microbiological Findings in Deep Caries Lesions

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SUMMARY

Introduction Caries is one of the most significant and widespread oral diseases. It has been confirmed that dental plaque, i.e. microorganisms in it, are the most important factor in the development of dental caries. Caries profunda represents deep carious lesion from where bacterial toxins may affect pulp through dentinal tubules. The aim of this study is to assess the efficacy of indirect pulp capping based on microbiological findings of bacteria present in deep carious lesions before and after the treatment.

Material and Methods The clinical study included 29 patients of both genders, aged 16 to 40 and 45 permanent teeth with deep caries lesions. The first microbiological sample was taken after cavity preparation and removal of soft dentin from the bottom of the cavity. The second sample was taken after the removal of temporary filling and calcium hydroxide paste 60 days after the indirect pulp capping treatment. The collected samples were stored in special sterile micro tubes (Eppendorf) and kept at the temperature of -80°C until microbiological analysis was performed. Samples were tested for the presence of the following microorganisms: *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans* and *Enterococcus faecalis* using the multiplex polymerase chain reaction (PCR) method.

Results The results showed that prior to the treatment of deep carious lesions the most common species was *E. faecalis* (80% of samples), followed by *A. actinomycetemcomitans* (32% of samples), while the least common was *P. gingivalis* (16% of samples). After the treatment with products based on calcium hydroxide, *E. faecalis* was registered in 18% of samples, *A. actinomycetemcomitans* in 16% of samples and *P. gingivalis* was not registered in any sample.

Conclusion The most common bacterial species in teeth with deep caries lesions was *E. faecalis*, whereas *A. actinomycetemcomitans* and *P. gingivalis* were found in lower number of samples.

Keywords: deep caries lesions; bacteria; indirect pulp capping

INTRODUCTION

Dental caries is surely one of the most significant oral diseases and it is widespread both in children and adults [1, 2, 3]. Caries profunda (deep caries lesion) is the place from where bacterial toxic agents through dentinal tubules can compromise pulp causing minor or major changes in it. If bacteria are removed or “captured” in the cavity after restoration caries lesion will stop spreading. Tubular sclerosis and tertiary dentin limit bacterial nutrition from pulp due to lower dentin permeability. It has also been known that microorganisms trapped in the cavity can change and become less pathogenic [4].

It has been confirmed that dental plaque (biofilm) and microorganisms in it are the most important factors in the development of dental caries. Due to the complex etiology and pathogenesis of this disease, its treatment still poses significant problem for most dental practitioners. In addition to *S. mutans*, *Lactobacillus spp.* and *Actinomyces spp.* pyogenic bacteria such as *Porphyromonas gingivalis*, *Prevotella intermedia* and *Aggregatibacter actinomycetemcomitans* can be detected in dental plaque [5].

Viola et al. [6] analyzed saliva samples from children with and without present caries lesions and found that caries lesion starts when glucose glucan polymer (produced by *S. mutans*) forms a biofilm on teeth to which other oral bacteria, food debris and saliva components adhere. Ito et al. [7] using different methodology confirmed this finding. Do et al. [8] found that *S. mutans* is the most common cause of dental caries. Kouidhi et al. [9] in their study confirmed the presence of enterococci in the oral cavity of children in Tunisia. They isolated 33.9% of enterococci out of all positive cocci identified in oral cavity. 55.8% of detected enterococci were isolated from carious lesions and only 2% were found in oral cavity of children who had no caries lesions.

In order to preserve pulp vitality and successfully treat deep caries lesions, timely and proper diagnosis is necessary as well as fast and efficient removal of carious dentin (as a primary reservoir of microorganisms), application of appropriate medications and sealed restoration [10]. Pharmacological agents used in the treatment of deep caries lesions must eliminate remaining bacteria but also stimulate odontoblasts to produce tertiary dentin. Products based on

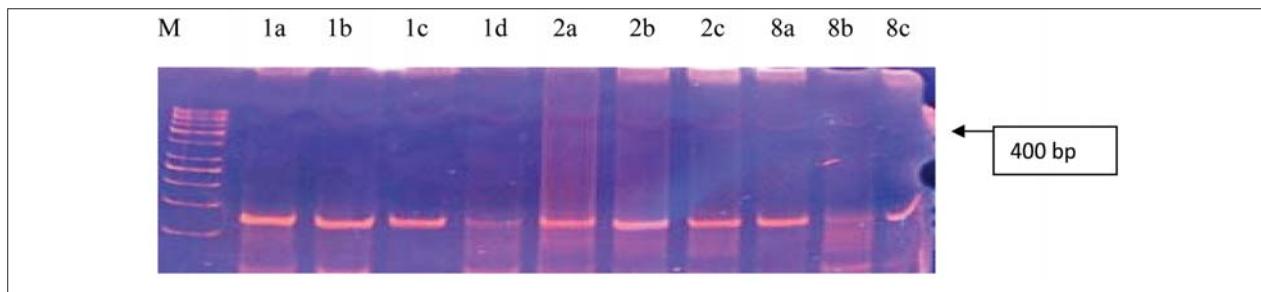


Figure 1. PAA gel with PCR results of 10 samples from three patients. The strip at height of 400 base pairs (bp) corresponds to *Enterococcus faecalis*.

Slika 1. PAA gel sa PCR proizvodima 10 uzoraka poreklom od tri pacijenta. Traka na visini od 400 baznih parova (bp) odgovara bakteriji *Enterococcus faecalis*.

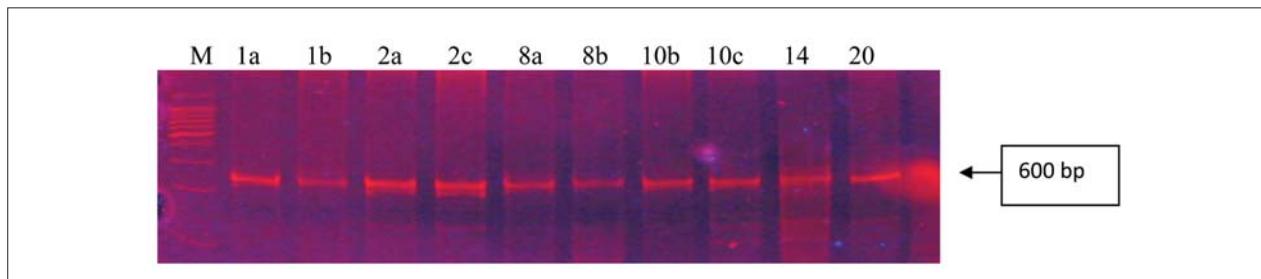


Figure 2. PAA gel with the PCR products of 10 teeth samples collected from ten patients. The strip at a height of 660 base pairs (bp) corresponds to *Aggregatibacter actinomycetemcomitans*.

Slika 2. PAA gel sa PCR proizvodima 10 uzoraka zuba poreklom od deset pacijenata. Traka na visini od 660 baznih parova (bp) odgovara bakteriji *Aggregatibacter actinomycetemcomitans*.

calcium hydroxide are the most commonly used agents in the treatment of deep caries lesions although in the last few years the use of MTA is increasing with very high success rate [11]. When applied at the bottom of clean cavity these materials stimulate odontoblasts to produce reparative dentin but also kill the remaining bacteria.

There is no consensus on the treatment of deep caries lesions. Some authors suggest complete removal of carious dentin prior to the application of medicaments while others recommend leaving a thin layer of dentin at the bottom of prepared cavity. Despite numerous achievements in modern dentistry and large number of pharmacological agents used in the treatment of caries profunda, successful treatment of deep caries lesions still depends on a number of factors [4, 12, 13, 14].

The aim of this study is to assess the efficacy of indirect pulp capping based on microbiological findings in deep carious lesions before and after the treatment.

MATERIAL AND METHODS

The clinical study included 29 patients of both genders, age 16 to 40 years, who had deep caries lesions present based on medical history, clinical and radiographic examination of 45 teeth. Each patient had assigned a special card where personal data, teeth status, precise data on medication and materials, presence of bacteria in collected samples and subjective and objective changes during the treatment protocol were recorded.

The first microbiological samples were collected after cavity preparation and removal of soft dentin from the bottom of the cavity. Using sterile cotton swab and

sterile forceps samples were collected from each caries lesion and then stored in special sterile micro tubes (Eppendorf) with 150 ml of carrier liquid and kept at -80°C until microbiological analysis. Using random selection method, after removing carious dentin calcium hydroxide agent (Dycal, DENTSPLY, Germany, or Calcipupe, Septodont, France) was applied and temporary filling placed (phosphate cement, Galenika, Serbia) for a period of two months. Two months later, the temporary filling and calcium hydroxide were removed from the cavity and from the bottom of the cavity another microbiological sample was taken with a sterile cotton swab and sterile forceps.

Bacterial DNA was isolated by treating the samples with proteinase K at the temperature of 56°C for 30 minutes, followed by enzyme inactivation by heating the samples at the temperature of 94°C for 15 minutes. Then after samples were kept at -20°C until PCR analysis was performed. The presence of the following microorganisms: *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans* and *Enterococcus faecalis* was analyzed. For PCR analysis a known primer sequences were used.

RESULTS

The analysis of microorganisms in biological samples collected from 45 teeth (where the number of analyzed teeth per patient varied from 1 to 4) showed that the most common species was *E. faecalis* (80%), followed by *A. actinomycetemcomitans* (32%) while the least frequent was *P. gingivalis* (16%).

The existence of electrophoretic strips of the expected length on the polyacrylamide gel indicated positive result

Table 1. Presence of the three tested microorganisms in collected samples**Tabela 1.** Učestalost tri ispitivana mikroorganizma kod pacijenata

Patient Pacijent	Gender Pol	First sample Bris
1	F/Ž	Pg, Aa, Ef
2	F/Ž	Pg, Aa, Ef
3	F/Ž	-
4	F/Ž	Aa
5	F/Ž	Pg, Aa, Ef
6	F/Ž	-
7	F/Ž	Pg
8	F/Ž	-
9	F/Ž	-
10	F/Ž	Aa, Pg
11	F/Ž	-
12	F/Ž	-
13	F/Ž	-
14	F/Ž	-
15	F/Ž	-
16	F/Ž	-
17	F/Ž	-
18	M/M	Ef
19	M/M	-
20	M/M	-
21	M/M	-
22	M/M	Aa
23	M/M	-
24	M/M	Aa, Ef
25	M/M	-
26	M/M	-
27	M/M	Pg
28	M/M	Aa
29	M/M	-

Pg – *Porphyromonas gingivalis*, Aa – *Aggregatibacter actinomycetemcomitans*; Ef – *Enterococcus faecalis*

F – female; M – male

Ž – ženski; M – muški

Table 2. Presence of certain microorganisms before and after applied treatment**Tabela 2.** Učestalost pojedinih mikroorganizama pre i posle primenjene terapije

Bacterial species Vrsta bakterije	Broj uzoraka (%)		χ^2	P
	Before treatment Pre terapije	After treatment Posle terapije		
<i>Aggregatibacter actinomycetemcomitans</i>	14 (32%)	7 (16%)	1.28	0.185
<i>Porphyromonas gingivalis</i>	7 (16%)	0 (0%)		0.001
<i>Enterococcus faecalis</i>	35 (80%)	8 (18%)	10.62	<0.001

for the tested species. Figure 1 shows gel with selected samples of *E. faecalis*. It is clear that one patient had *E. faecalis* detected in all 4 tested teeth (1a, 1b, 1c, 1d) but the 1d sample probably had smaller count of bacteria (PCR is only a semi-quantitative technique). Another patient (2a, 2b, 2c) also had this species detected in all three teeth. In one case (8a, 8b, 8c) *E. faecalis* was only detected in only one sample (8b).

Figure 2 shows a polyacrylamide gel with selected samples positive for *A. actinomycetemcomitans*. The level

of amplification was fairly uniform which is uncommon for PCR reactions on bacteriological isolates from teeth.

More than one third of patients showed the presence of some of the tested bacteria (17 out of 29 patients) (Table 1). Three patients had co-infection of all three species *E. faecalis*, *A. actinomycetemcomitans* and *P. gingivalis*. Interestingly, all three patients were female. In addition, two patients had *E. faecalis* and *A. actinomycetemcomitans* and one patient had *P. gingivalis* and *A. actinomycetemcomitans* as well as *E. faecalis* and *P. gingivalis*.

Two months after the treatment of deep caries lesions the incidence of all three microorganisms in collected samples decreased significantly. The number of samples positive to *E. faecalis* (16%) and *P. gingivalis* (0%) was significantly lower than before the treatment ($p<0.05$), while the number of samples positive to *A. Actinomycetemcomitans* was not significantly different from before the treatment (Table 2).

DISCUSSION

Dental caries is one of the most significant and most widespread oral diseases. Due to its very complex etiology and pathogenesis, the treatment outcome is often uncertain.

Bjørndal et al. [15] in their study done on 314 patients at the Faculty of Dentistry in Copenhagen found that deep caries lesions more frequently affected posterior teeth compared to anterior teeth. In agreement with this study Ahmad et al. [1] revealed that out of 204 teeth with deep caries lesions 21 teeth were incisors and 183 were posterior teeth.

Maeda et al. [16] investigated the influence of oral streptococci and lactobacilli on pH levels in active caries lesions on 24 extracted human molars and concluded that pH value of carious dentin was lower than pH value of intact dentin. They also concluded that there was a significant correlation between decreasing pH and demineralization in active caries lesions. Using the PCR method and pH imaging microscope, Maeda et al. found that the lowest pH value was registered in dentin samples affected by active caries lesions where *S. mutans* and other oral bacteria were detected. In 7 out of 8 samples with the lowest pH, the authors detected *S. mutans* only, which is the most important species in forming biofilm and starting dentin destruction [16].

Estrela et al. [11] examined the effect of several agents used in the treatment of deep caries lesions. They found that MTA, Portland cement, Dycal, calcium hydroxide paste and Sealapeax have antibacterial effect against several bacterial species (*Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Staphylococcus aureus*) and fungi (*Candida albicans*). After two-day incubation period calcium hydroxide paste showed the best antimicrobial effect (inhibition zone was 6 to 9.5 mm and diffusion zone 10-18 mm). Results for Dycal showed no inhibition zone, nor diffusion zone, which indicated weak antimicrobial activity. In 2010 Parolia et al. [12] in their study on 36 premolars confirmed the results of previous authors.

Good adhesion to the walls of the cavity physically prevents penetration of bacteria toward the pulp and is an important prerequisite for the success of the indirect pulp capping treatment. However, as there is no material that provides an adequate marginal seal, it is very important that restorative procedure uses materials with good adhesive properties and restoration techniques that will ensure good adhesive bond of material with the cavity walls.

Pyogenic bacteria such as *P. gingivalis*, *P. intermedia* and *A. actinomycetemcomitans* have also been detected in dental plaque [18, 19]. In addition to the anaerobic cultivation of microorganisms, PCR techniques (such as hybridization technique) have been used for bacterial identification [5]. Martin et al. [20] using PCR method performed microbiological analysis of 65 teeth with deep caries lesions and inflamed pulp and found that anaerobic bacteria play an important role in development of caries lesions and endodontic infections. Kneist et al. [21] analyzed bacteria found in caries lesions of primary teeth after chemical-mechanical method (CARISOLV™ system) was used for caries removal. They found that number of bacteria in deep caries lesions was significantly higher than in superficial lesions (caries media). Also, their study showed that most commonly found bacteria in prepared cavity were oral streptococci (*S. mutans*, *S. intermedia* etc.) then *Actinomyces spp.* and *Lactobacillus spp.* [21].

Aas et al. [22] conducted a study on 90 patients (51 with deep caries lesions and diagnosed pulpitis). Microbiological and PCR methods revealed the presence of anaerobic bacteria while *Veillonella*, *Lactobacillus*, *Bifidobacterium* and *Propionibacterium*, *Actinomyces spp.*, and *Atopobium spp.*, with *S. mutans*, played an important role in the progression of caries lesions. Using PCR method on 20 samples of dental plaque in subjects of different ages (children aged 5 to 6 and adults), Cheon et al. [23] found that large number of genotypes of *S. mutans* (ranging from 1.6 to 2.4) were more prevalent in children than in adults.

Duque et al. [24] examined the effects of glass ionomer cement (Fuji) and Dycal in the treatment of deep caries lesions in 27 permanent molars. PCR method confirmed the presence of *S. mutans* and *Lactobacillus spp.* before and 3 months after the treatment of deep caries lesions. However, there was a significant reduction in the number of these bacteria after completed treatment.

It has been confirmed that 90% of enterococcal infections in humans are caused by *E. faecalis*. This species can survive in extremely difficult conditions, as it is adaptable to different environmental conditions. It can also become resistant to the lethal dose of hydrogen peroxide, ethanol and pH changes. Studies of Perez et al. [25] and Love et al. [26] showed that *E. faecalis* can be found in dentinal tubules of teeth with caries lesions. Kayaoglu and Örstavik [27] pointed out the significance of *E. faecalis* in the occurrence of endodontic disease and periapical inflammation. Kolenbrander et al. [28] found *A. actinomycetemcomitans* and *P. gingivalis* to be one of the most significant bacteria in the development of caries lesions [26]. Gomez et al. [29] examined the efficacy of chlorhexidine and calcium hydroxide against *E. faecalis* and found

that chlorhexidine completely inhibited its growth while calcium hydroxide had no effect.

The most commonly detected species in caries lesions prior to the treatment in the current study was *E. faecalis*, followed by *A. actinomycetemcomitans* while the least common was *P. gingivalis*. After the treatment with calcium hydroxide products, there was a significant reduction in the number of *E. faecalis* and *A. actinomycetemcomitans*, while *P. gingivalis* was not detected in any samples. This can be explained by the fact that *E. faecalis* was probably effectively mechanically removed using burs or it diffused into dentinal tubules. Another reason why it was not detected could be a good marginal seal achieved with phosphate cement after application of calcium hydroxide medicaments during 60 days. Considering that medicaments based on calcium hydroxide do not have killing effect on *E. faecalis*, its decrease was probably due to the correct mechanical removal of caries and good restorative filling done by the same practitioner in adequate clinical conditions. Remaining *E. faecalis* in deeper layers of dentinal tubules and inefficient removal of carious dentin may be reasons for failure of indirect pulp capping, which consequently can lead to inflammation of the pulp and need for endodontic treatment.

CONCLUSION

Prior to the treatment of deep caries lesions the most commonly detected bacterial species was *E. faecalis*, followed by *A. actinomycetemcomitans* while the least common was *P. gingivalis*. After indirect pulp capping, *E. faecalis* and *A. actinomycetemcomitans* were detected in significantly smaller number of samples while *P. gingivalis* was not found in any sample.

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Analiza mikrobiološkog statusa dubokih karijesnih lezija

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KRATAK SADRŽAJ

Uvod Karijes je jedno od najznačajnijih i najrasprostranjenijih oboljenja usne duplje. Danas je sigurno da su dentalni plak, odnosno mikroorganizmi u njemu, najvažniji faktor nastanka karijesa. *Caries profunda* je duboka karijesna lezija koja predstavlja mesto odakle bakterijsko-toksični agensi preko dentinskih kanalića ugrožavaju pulpu. Cilj ovog rada je bio da se na osnovu mikrobiološke analize bakterija zastupljenih u karijesnoj leziji pre i posle terapije, odnosno na osnovu kliničkih istraživanja proveri efikasnost lečenja dubokih karijesnih lezija indirektnim prekrivanjem pulpe.

Materijal i metode rada Kliničko istraživanje je obuhvatilo 29 pacijenata ova pola, uzrasta od 16 do 40 godina, odnosno 45 stalnih zuba sa dubokim karijesnim lezijama. Posle preparacije kaviteta i uklanjanja razmekšalog dentina, sa dna kaviteta je uzet prvi bris. Drugi bris je uzet posle delovanja i uklanjanja privremenog ispuna i paste kalcijum-hidroksida nakon 60 dana. Uzeti brisevi su odloženi u posebne sterilne mikrotubice (ependorfe) i čuvani na temperaturi od -80°C do mikrobiološke analize. Uzorci materijala su ispitani na prisustvo sledećih mikroorganizama: *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans* i *Enterococcus faecalis* primenom metode multipleks tehnika reakcije lančanog umnožavanja DNK (engl. polymerase chain reaction – PCR).

Rezultati Rezultat je pokazao da je pre početka lečenja dubokih karijesnih lezija najčešća bakterija bila *E. faecalis* (80% uzorka), potom *A. actinomycetemcomitans* (32% uzorka), dok je najreda bila bakterija *P. gingivalis* (16% uzorka). Nakon sprovedene terapije preparatima na bazi kalcijum-hidroksida, *E. faecalis* je zabeležen u 18% uzorka, a *A. actinomycetemcomitans* u 16%, dok *P. gingivalis* nije registrovan ni u jednom uzorku.

Zaključak U Zubima sa dubokim karijesnim lezijama najčešća bakterija bila je *E. faecalis*, potom *A. actinomycetemcomitans*, a u najmanjem broju uzoraka je ustanovaljen *P. gingivalis*.

Ključne reči: duboki karijes; bakterije; indirektno prekrivanje

UVOD

Karijes je sigurno jedno od najznačajnijih oboljenja usne duplje i široko je rasprostranjeno i kod dece i kod odraslih [1, 2, 3]. *Caries profunda* (duboki kvar zuba) je mesto odakle bakterijsko-toksični agensi preko dentinskih kanalića ugrožavaju pulpu, uslovjavajući manje ili veće promene u njoj. Mogućnost zaustavljanja daljeg širenja lezije postoji ukoliko se bakterije uklone ili „zarobe“ u kavitetu nakon restauracije. Tubularna skleroza i tercijarni dentin ih mogu izolovati jer je sprečena njihova mogućnost ishrane iz pulpe zbog manje permeabilnosti dentina. Poznato je takođe da zarobljeni mikroorganizmi u kavitetu mogu da se menjaju i da pri tom postaju manje patogeni [4].

Danas je sigurno da su dentalni plak (biofilm), odnosno mikroorganizmi koji se nalaze u njemu, najvažniji faktor nastanka karijesa. Zbog vrlo kompleksne etiologije i patogeneze ovog oboljenja, njegova terapija je i dalje značajan problem za većinu stomatologa praktičara. U zubnom plaku je osim *Streptococcus mutans*, *Lactobacillus* spp. i *Actinomyces* spp. moguće otkriti i prisustvo piogenih bakterija, kao što su *Porphyromonas gingivalis*, *Prevotella intermedia* i *Aggregatibacter actinomycetemcomitans* [5].

Viola (*Viola*) i saradnici [6] su u svojoj studiji, na osnovu uzorka iz pljuvačke uzetih od dece s karijesnim lezijama i bez ovih lezija, utvrdili da karijes započinje onda kada glukan-poliimer glukoze (stvara ga *S. mutans*) formira na površini zuba biofilm na koji prianjaju oralne bakterije, ostaci hrane i komponente iz pljuvačke. Do istog zaključka su došli i Ito (*Ito*) i saradnici [7] bez obzira na drugačiju metodologiju tokom istraživanja. Do (*Do*) i saradnici [8] su utvrdili da je *S. mutans* najčešći uzročnik nastanka dentalnog karijesa. Kuidi (*Kouidhi*)

i saradnici [9] su u svojim iskazima potvrdili prisustvo enterokokusa u usnoj duplji dece u Tunisu. Oni su izolovali 33,9% enterokokusa od svih pozitivnih koka identifikovanih iz oralne duplje, pri čemu je 55,8% enterokokusa izolovano iz karijesnih lezija, a samo 2% iz usne duplje dece bez karijesa.

Za očuvanje vitaliteta pulpe i uspešnu terapiju dubokog karijesa neophodni su pravovremena i pravilna dijagnoza, brzo i efikasno uklanjanje karijesno promjenjenog dentina (kao osnovnog rezervoara mikroorganizama), primena odgovarajućih medikamenata i kvalitetna restauracija kavite [10]. Medikamentna sredstva koja se koriste u lečenju dubokog karijesa imaju zadatak da deluju na zaostale mikroorganizme, ali i da stimulišu odontoblaste na stvaranje tercijarnog dentina. Preparati na bazi kalcijum-hidroksida su najčešće korišćena sredstva u lečenju dubokog karijesa iako se poslednjih godina u ove svrhe sve više koristi i MTA s vrlo visokim procentom uspešnosti [11]. Aplikovani na dno preparisanog kavite, ovi materijali stimulišu odontoblaste na proizvodnju reparativnog dentina, ali deluju i antibakterijski na zaostale mikroorganizme u tankom sloju sačuvanog dentina.

Mišljenja autora o terapiji dubokog karijesa i danas su podejljena. Jedni smatraju da je pre primene medikamentnih sredstava neophodno potpuno ukloniti karijesno promjenjeni dentin, dok drugi zagovaraju pristup sa delimičnim uklanjanjem razmekšalog dentina, te ostavljanjem tankog sloja dentina na dnu preparisanog kavite. Bez obzira na veliki napredak moderne stomatologije i veliki broj medikamentnih sredstava koji se danas koriste u lečenju karijesa, terapija dubokog karijesa se i dalje smatra složenim postupkom čiji uspeh zavisi od brojnih faktora [4, 12, 13, 14].

Cilj ovog istraživanja bio je da se na osnovu mikrobiološke analize bakterija u karijesnoj leziji, pre i posle terapije, odnosno

na osnovu kliničkih istraživanja, proveri efikasnost lečenja dubokih karijesnih lezija postupkom indirektnog prekrivanja pulpe.

MATERIJAL I METODE RADA

Kliničko istraživanje je obuhvatilo 29 pacijenata oba pola, uzrasta od 16 do 40 godina, kod kojih je na osnovu anamneze, kliničkog i radiografskog pregleda 45 zuba dijagnostikovan duboki karijes. Za evidentiranje dobijenih podataka ovog istraživanja napravljen je poseban karton za svakog pacijenta, gde su upisani lični podaci, podaci o stanju zuba i precizni podaci o lekovima i materijalima, zastupljenosti bakterija u uzetim brisevima, odnosno o subjektivnim i objektivnim promenama tokom terapijskog protokola.

Posle preparacije kaviteta i uklanjanja razmekšalog dentina, sa dna kaviteta je uzet prvi uzorak za mikrobiološku analizu. Uzorak je uzet sterilnom kuglicom vate i sterilnom pincetom, a potom odložen u posebne sterilne mikrotubice (ependorfe) sa 150 ml transportne tečnosti i čuvan na temperaturi od -80°C do mikrobiološke analize. Metodom slučajnog izbora kod pacijenta je u očišćeni kavitet aplikovano sredstvo na bazi kalcijum-hidroksida (*Dycal*, *DENTSPLY*, Nemačka, ili *Calcipulpe*, *Septodont*, Francuska), a potom je kavitet ispunjen materijalom za privremeno zatvaranje (fosfatnim cementom, Galenika, Srbija) tokom dva meseca. Nakon dva meseca iz kaviteta su uklonjeni privremeni ispun i preparat na bazi kalcijum-hidroksida, a sa dna kaviteta uzet je drugi mikrobiološki uzorak sterilnom vativicom i sterilnom pincetom.

Izolacija eventualno prisutne bakterijske DNK vršena je tretilanjem uzorka proteinazom K na temperaturi od 56°C tokom 30 minuta, nakon čega je sledila inaktivacija enzima zagrejavanjem uzorka na temperaturi od 94°C tokom 15 minuta. Tako pripremljeni materijal čuvan je na -20°C do kompletne PCR analize. Uzorci materijala su ispitani na prisustvo sledećih mikroorganizama: *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans* i *Enterococcus faecalis*. Za izvođenje PCR reakcije korišćene su poznate sekvence prajmera.

REZULTATI

Analiza mikroorganizama u biološkom materijalu uzetom iz 45 zuba (pri čemu je broj analiziranih zuba po pacijentu varirao od 1 do 4) pokazala je da je najčešći bio *E. faecalis* (80%), potom *A. actinomycetemcomitans* (32%), dok je najpređi bio *P. gingivalis* (16%).

Postojanje elektroforetskih traka očekivane dužine na poliakrilamidnom gelu označavalo je pozitivan nalaz za ispitivanu bakteriju. Na slici 1 prikazan je gel sa odabranim uzorcima *E. faecalis*. Jasno se vidi da je kod jednog pacijenta ova bakterija otkrivena u sva četiri analizirana zuba (1a, 1b, 1c, 1d), s tim da je u uzorku 1d verovatno bila nešto ređa (PCR je samo semi-kvantitativna tehnika). Kod drugog pacijenta (2a, 2b, 2c) u sva tri ispitana zuba takođe je otkrivena ova bakterija, dok je kod jednog pacijenta (8a, 8b, 8c) uočena samo u uzorku 8b.

Na slici 2 prikazan je poliakrilamidni gel s odabranim uzorcima pozitivnim na *A. actinomycetemcomitans*. Nivo amplifikacije je bio prilično ujednačen u većini uzoraka, što je relativno neuobičajno za PCR reakcije na bakterijskim izolatima iz zuba.

Ako se posmatra incidencija infekcija, kod 17 pacijenata otkrivena je bar jedna ispitivana bakterija (Tabela 1). Kod tri pacijenta ustanovljena je koinfekcija sve tri bakterije. Zanimljivo je da su sva tri pacijenta bila ženskog pola. Takođe, kod dva pacijenta ustanovljene su istovremeno *E. faecalis* i *A. actinomycetemcomitans*, dok su kod po jednog pacijenta zabeleženi istovremeno *P. gingivalis* i *A. actinomycetemcomitans*, kao i *E. faecalis* i *P. gingivalis*.

Analiza postojanja mikroorganizama u brisevima nakon primjene terapije pokazala je da se učestalost sve tri bakterije značajno smanjila. Kod *E. faecalis* (16%) i *P. gingivalis* (0%) to smanjenje je bilo visoko statistički značajno ($p < 0,05$), dok kod *A. actinomycetemcomitans* nije bilo (Tabela 2).

DISKUSIJA

Karijes je jedno od najznačajnijih i najrasprostranjenijih oboljenja usne duplje. Zbog njegove vrlo složene etiologije i patogeneze, lečenje je i dalje značajan problem i često s vrlo neizvesnim ishodom.

Bjørndal (*Bjørndal*) i saradnici [15] su u svome istraživanju izvedenom na 314 pacijenata na Stomatološkom fakultetu u Kopenhagenu utvrdili da su zubi bočnog segmenta bili češće zahvaćeni dubokim karijesom u odnosu na frontalne zube. S prethodnim istraživanjem su se složili i Ahmad (*Ahmad*) i saradnici [1], koji su realizovali istraživanje na 204 zuba sa dubokim karijesom (21 zub su činili sekutići, a 183 zubi bočnog segmenta).

Maeda (*Maeda*) i saradnici [16] su ispitivali uticaj oralnih streptokoka i laktobacila na nivo pH u aktivnoj karijesnoj ležiji kod 24 ekstrahovana humana molara inficirana karijesom i zaključili da je pH vrednost dentina zahvaćenog karijesom bila niža od pH vrednosti intaktnog dentina. Takođe su zaključili da postoji značajna korelacija između sniženja pH vrednosti i demineralizacije u aktivnim karijesnim lezijama. Koristeći PCR metodu i pH-imidžing mikroskop, ovi autori su utvrdili da je najniža pH vrednost registrovana u uzorcima dentina zahvaćenim aktivnim karijesnim lezijama u kojima su otkriveni *S. mutans* i veliki broj drugih oralnih bakterija. U sedam od osam uzoraka s najvišim pH vrednostima autori su zabeležili postojanje samo *S. mutans*, koji formira biofilm i započinje dentinskog destrukciju zajedno sa drugim bakterijama koje stvaraju aktivnu karijesnu leziju [16].

Estrela (*Estrela*) i saradnici [11] su ispitivali dejstvo nekoliko lekova koji se koriste u terapiji dubokog karijesa. Istražujući antimikrobni efekat MTA, Portland cementa, *Dycal*, paste na bazi kalcijum-hidroksida, i *Sealapeax* na nekoliko vrsta bakterija (*Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Staphylococcus aureus*) i gljivicu (*Candida albicans*). Posle dvodnevног inkubacionog perioda ustanovili su da je pasta na bazi kalcijum-hidroksida imala najveće antimikrobno dejstvo i najbolji terapijski učinak (izmerena zona inhibicije je bila 6–9,5 mm, a zona difuzije 10–18 mm). Rezultati za pastu *Dycal* su pokazali da nije bilo ni zone inhibicije, niti zone difuzije, što je ukazivalo na slabo antimikrobno dejstvo. Parolija (*Parolia*) i saradnici [12] su u svome istraživanju na 36 premolara takođe potvrdili rezultate prethodnih autora.

Dobro prianjanje materijala za zidove kaviteta fizički sprečava prodor bakterija ka pulpi i važan je preduslov za uspeh

lečenja indirektnog prekrivanja pulpe. Međutim, s obzirom na to da danas ne postoji nijedan materijal koji obezbeđuje odgovarajuće rubno zatvaranje, veoma je važno da se u restaurativnoj proceduri koriste materijali sa dobrim adhezivnim svojstvima i tehnike restauracije koje će obezbediti dobru adhezivnu vezu materijala sa zidovima kavite.

U Zubnom plaku je takođe moguće otkriti piogene bakterije, kao što su *Porphyromonas gingivalis*, *Prevotella intermedia* i *Aggregatibacter actinomycetemcomitans* [18, 19]. Pored anaerobnog kultivisanja mikroorganizama primenjuju se i testovi za otkrivanje njihovih antigena, kao što je tehnika hibridizacije, odnosno PCR metoda identifikacije, koja je korišćena i u ovom radu [5]. Istraživanja Martina (*Martin*) i saradnika [20] na 65 zuba sa dubokim karijesnim lezijama i upaljenom pulpom pokazala su (na osnovu PCR metode) da anaerobne bakterije imaju važnu ulogu u nastanku karijesa i endodontske infekcije. Knajst (*Kneist*) i saradnici [21] su uklanjali karijesne mase na mlečnim zubima hemomehaničkom metodom (CARISOLV™ sistemom) a zatim uzimali bris sa dna kavite za mikrobiološku analizu. Utvrđili su da je broj bakterija kod dubokog karijesa znatno veći nego u brisevima uzetim iz pličih karijesnih destrukcija (*caries media*). Oni su takođe identifikovali bakterijske sojeve u preparisanom kavitetu, gde su najčešće bile oralne streptokoke (*S. mutans*, *S. intermedia* itd.), zatim vrste roda *Actinomyces*, kao i vrste roda *Lactobacillus* [21].

As (*Aas*) i saradnici [22] su izveli istraživanje kod 90 ispitanika (51 sa dubokim karijesom i dijagnostikovanim pulpitism). Zasejavnjem na bakterijskim kulturama i PCR metodom procenili su učestalost anaerobnih bakterija i zaključili da bakterije *Veillonella*, *Lactobacillus*, *Bifidobacterium* i *Propionibacterium*, *Actinomyces* spp. i *Atopobium* spp., uz *S. mutans*, imaju važnu ulogu u razvoju karijesa. Čeon (*Cheon*) i saradnici [23] su koristeći PCR metodu na 20 uzoraka dentalnog plaka kod ispitanika različite starosne dobi (dece uzrasta od pet do šest godina i odraslih) zaključili da je veći broj genotipova bakterije *S. mutans* (u rasponu od 1,6 do 2,4) bio češći kod dece nego kod odraslih ispitanika.

Dik (*Duque*) i saradnici [24] su ispitivali efekte glasjonomercementa (*Fuji*) i paste *Dycal* u terapiji dubokog karijesa na 27 stalnih molara. Primenom PCR metode utvrđene su bakterijske vrste *S. mutans* i *Lactobacillus* pre i tri meseca posle lečenja dubokog karijesa. Utvrđeno je značajno smanjenje broja ovih bakterija u uzorcima.

Potvrđeno je da je 90% enterokoknih infekcija kod čoveka izazvano s *E. faecalis*. Ova bakterija može da preživi u ekstremno teškim uslovima, jer se može prilagoditi različitim uslovima sredine. Ona postaje manje osetljiva na letalne doze vodonik-

peroksida i etanola, te na promene pH sredine. Studije Perez (*Perez*) i saradnika [25] i Lava (*Love*) i saradnika [26] su pokazale da se *E. faecalis* nalazi u dentinskim tubulima zuba s karijesnim lezijama, što je jedan od razloga izvođenja i naše studije. Kajaoglu (*Kayaoglu*) i Orstavik (*Ørstavik*) [27] su ukazali na veliki značaj *E. faecalis* u nastanku endodontskih oboljenja i periapikalnih zapaljenja. Kolenbrander (*Kolenbrander*) i saradnici [28] su ispitujući bakterije u dentalnom plaku (biofilmu), kao jednom od najznačajnijih faktora u nastanku karijesa, uočili i postajanje *A. actinomycetemcomitans* i *P. gingivalis*. Gomez (*Gomez*) i saradnici [29] su ispitujući uticaj hlorheksidina i kalcijum-hidroksida na 180 intaktnih govedih zuba inficiranih sa *E. faecalis* zaključili da hlorheksidin potpuno inhibira rast ove bakterije, dok kalcijum-hidroksid nije imao uticaja na njen rast.

Analiza briseva uzetih od pacijenata u ovom istraživanju pre početka lečenja pokazala je da je najčešća bakterija bila *E. faecalis*, zatim *A. actinomycetemcomitans* i *P. gingivalis*. Nakon primenjene terapije preparatima na bazi kalcijum-hidroksida, došlo je do značajnog smanjenja broja *E. faecalis* i *A. actinomycetemcomitans* u tretiranim uzorcima, dok *P. gingivalis* nije zabeležen ni u jednom uzorku. Ovo smanjenje broja bakterije *E. faecalis* može se objasniti činjenicom da je *E. faecalis* verovatno efikasno mehanički uklonjen rotirajućim instrumentima ili je difundovao u dentinske tubule. Drugi razlog što nije uočen na dnu kavite mogao bi biti dobro rubno zatvaranje fosfatnim cementom nakon primene medikamenta na bazi kalcijum-hidroksida tokom 60 dana. S obzirom na to da preparati na bazi kalcijum-hidroksida nemaju izrazit efekat na *E. faecalis*, njegovo smanjenje je verovatno posledica korektnog mehaničkog uklanjanja karijesnih masa i dobrog restaurativnog ispuna koje je realizovan isti terapeut u odgovarajućim kliničkim uslovima. Zaostajanje *E. faecalis* u dubljim slojevima dentinskih tubula i neefikasno ukljanjanje karijesa mogu biti i razlog neuspela indirektnog prekrivanja pulpe, što posledično može dovesti do upale pulpe i zahteva za endodontskom intervencijom na oboleloj pulpi.

ZAKLJUČAK

Pre početka lečenja dubokih karijesnih lezija najčešća bakterija je bila *E. faecalis*, potom *A. actinomycetemcomitans*, dok je najređa bila *P. gingivalis*. Nakon primenjene terapije indirektnog prekrivanja pulpe, *E. faecalis* i *A. actinomycetemcomitans* su zabeleženi u značajno manjem broju, a *P. gingivalis* nije otkriven ni u jednom uzorku.

In Vitro Comparative Evaluation of Microleakage of Newly Introduced Dyad Flow and Total and Self Etch Adhesives in Class V Resin Composite Restorations

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SUMMARY

Introduction The aim of this study was to evaluate marginal sealing ability of newly introduced Dyad Flow flowable composite and compare to total-etch and self-etch adhesive system at the coronal and apical margins of class V resin composite restorations.

Material and Methods A standard class V cavity (3 mm mesiodistal width, 3 mm occlusogingival height and 1.5 mm axial depth) was prepared on the buccal surface of freshly extracted sound human teeth. Occlusal and gingival margins of the cavities were located in enamel and cementum/dentin, respectively. Teeth were randomly assigned into the three groups ($n=10$) and restored with different composite materials following the manufacturer's instructions: group I was restored with nanohybrid resin composite using total-etch bonding agent; group II was restored with nanohybrid resin composite using self-etch technique; group III was restored with flowable composite (Dyad Flow), respectively. After finishing and polishing, the teeth were coated with nail varnish and immersed in rhodamine B dye and sectioned longitudinally. Dye penetration was examined under stereomicroscope and scored separately for occlusal and gingival margins on a 0–3 ordinal scale. Data were analyzed with Kruskal–Wallis, Mann–Whitney and Wilcoxon tests ($\alpha=0.05$).

Result Statistical analysis showed that specimens restored with the total-etch and self-etch adhesive systems revealed reduced leakage at the coronal margin. At the apical margin, Dyad Flow showed greater leakage than other groups.

Conclusion Newly introduced flowable composite Dyad Flow showed inferior adhesive bond with enamel and dentin compared to total-etch and self-etch techniques.

Keywords: Dyad Flow; total-etch; self-etch

INTRODUCTION

The search for an ideal dental restorative material, exhibiting appropriate physical and mechanical properties, as well as, excellent aesthetics, has resulted in the introduction of light cured composites. These resins have been widely used as restorative materials for both anterior and posterior teeth. With passage of time various changes are seen in composite bonding system. Due to polymerisation shrinkage of these materials, successful adhesion to enamel and dentin is an indispensable prerequisite for clinical success; otherwise gap formation would endanger clinical success [1, 2].

Enamel bonding has been accepted as clinically strong and durable, because acidic etchants, such as 30–40% phosphoric acid, create enamel microporosities allowing the penetration of monomers consecutively generating micromechanical retention [3, 4]. In contrast, dentin is an unpredictable substrate for adhesion due to tubular structure, high organic content, and intrinsic wetness [5, 6, 7].

To solve the problem, different approaches have been reported in the literature. In two-step total-etch systems, a separate etch and rinse phase is still involved, but a hydrophilic primer and hydrophobic resin are combined into

one application. Although increased technique sensitivity is reported [8, 9] for total-etch adhesives, similar clinical performance is achieved for both conventional and simplified total-etch adhesive versions [10, 11]. Self-etch adhesives represent an alternative approach in enamel-dentin bonding. They do not require a separate acid etch step and are based on the use of nonrinse acidic monomers that simultaneously condition and prime dentin and enamel [8, 12, 13, 14]. This approach eliminates rinsing phase and does not require application of primer in particular conditions of wetness due to the self-etch adhesives' water content; reduced technique-sensitivity and the risk of making errors during application are achieved. For these reasons, their popularity is increasing [15]. Flowable restorative resins with a low viscosity are recommended as the material of choice for restoring Class V cavities. Flowable composites are easier to place and more self-adaptable compared to conventional restorative resin composites [16]. Dyad Flow is new self adhesive flowable composite resin which can be seen as an alternative to the previous time-consuming procedures. It is self adhering composite in which no separate bonding protocol is required. It has fluoride releasing property and its translucent quality provides excellent aesthetics in the vast majority of situations.

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The aim of this study was to assess the microleakage of class V cavities restored with a new self-adhesive flowable composite resin and to compare with two-step total-etch and self-etch adhesive system. All used adhesives were also tested for their bonding ability to enamel and dentin.

MATERIAL AND METHODS

A total of 30 intact human teeth were collected and stored in saline at the room temperature for 30 days. A standard class V cavity (3 mm mesiodistal width, 3 mm occlusogingival height, and 1.5 mm axial depth) was prepared at the cementoenamel junction (CEJ) on the facial surface of each tooth.

The teeth were randomly assigned into the three groups (10 teeth in each group): Group A was restored with 3M nanohybrid resin Composite using Total etch technique with 3M Single Bond Adhesive. Group B was restored with 3M nanohybrid resin composite using self-etch

technique with Clear fil self-etch bonding agent. Group C was restored with Dyad Flow composite.

Resin composite shade A2 was used for each group. These were placed in two increments; each increment was cured for 20 s according to manufacturer's instructions. The restorations were finished with finishing diamond burs and polished with aluminum oxide discs under constant air/water coolant.

The root apices of specimens were sealed with sticky wax; all external surfaces were covered with two layers of nail varnish except for 1.0 mm around the restorations and then immersed in a Rhodamine B dye solution for 24 hours.

The specimens were rinsed in running water, dried and then sectioned faciolingually. The dye penetration depth along the cavity wall (including both occlusal and gingival margins) was measured with a stereomicroscope. The microleakage score was recorded separately for both occlusal and cervical margins on a nonparametric ordinal scale from 0 to 3 (Table 1).

Data were analyzed using Kruskall-Wallis analysis of variance and Mann-Whitney U-test for comparing the restorative materials.

RESULTS

Microleakage was observed in all restorations at occlusal and cervical margins. Kruskall-Wallis analysis of variance showed no significant difference between the total etch and the self-etch group ($p=0.001$). Dyad Flow showed significant microleakage at occlusal and cervical margins ($p>0.05$) (Table 2, Graphs 1 and 2).

Table 1. Scoring ordinal scale

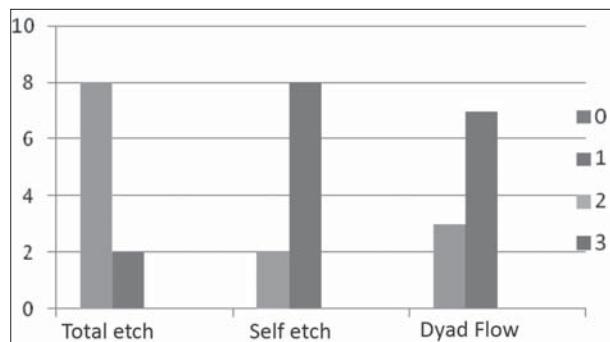
Tabela 1. Neparametrijska skala rezultata

Microleakage score Ocena mikrocurenja	Result Rezultat
0	No microleakage Nema mikrocurenja
1	Dye penetration less than ½ of axial wall Prodor boje manje od polovine zida
2	Dye penetration more than ½ of axial wall Prodor boje više od polovine zida
3	Dye penetration spreading along the axial wall Prodor boje duž celog zida

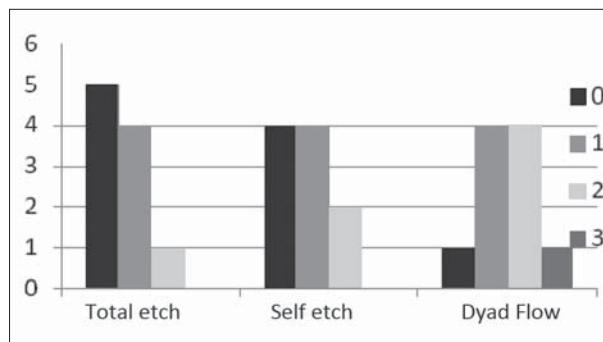
Table 2. Frequency, mean value \pm SD of microleakage scores, and p value of the Wilcoxon signed rank test of the three groups used on occlusal and gingival margins (n=10)

Tabela 2. Učestalost, srednja vrednost \pm SD za vrednost mikrocurenja, i vrednost p Vilkonsonovog testa rangova kod sve tri grupe na okluzalnim i gingivalnim zidovima kaviteta (n=10)

Groups Grupe	Occlusal margin Okluzalni zid				Cervical margin Gingivalni zid				p		
	Microleakage score Ocena mikrocurenja				Mean \pm SD $\bar{X}\pm SD$	Microleakage score Ocena mikrocurenja					
	0	1	2	3		0	1	2	3		
Total-etch	8	2	0	0	0.020 \pm 0.422	5	4	1	0	0.60 \pm 0.699	0.206
Self-etch Samonagrizajući	2	8	0	0	0.80 \pm 0.426	4	4	2	0	1.10 \pm 0.738	0.180
Dyad Flow	3	7	0	0	0.60 \pm 0.516	1	4	4	1	1.50 \pm 0.850	0.024*



Graph 1. Microleakage graph score at occlusal margin
Grafikon 1. Ocena mikrocurenja na okluzalnom zidu



Graph 2. Microleakage graph score at cervical margin
Grafikon 2. Ocena mikrocurenja na gingivalnom zidu

DISCUSSION

Microleakage has been defined by Sidhu and Henderson as "The clinically undetectable passage of bacterial fluids, molecules or ions between a cavity wall and the restorative material applied to it" [17]. The primary objective of a dental restoration is to create a 'perfect' seal, and prevent leakage of contaminants contained in the oral environment. However, long-term microleakage occurs in all restorations [18].

Microleakage is more critical in class V cavities located both in dentin and/or cementum, which may lead to a weaker marginal seal than that on the enamel surface; adhesion between composite resins and dentin is not as strong as with enamel [19, 20]. Filling material can be dislodged occlusally during polymerization contraction, causing poor adaptation of the restoration at the cervical margin [21]. Higher organic component, tubular structure, fluid pressure and lower surface energy make bonding to dentin more difficult than enamel [22].

In the present study, microleakage was assessed in newly introduced Dyad Flow and compared to total etch and self-etch adhesive system at the coronal and apical margins of class V resin composite restorations. The use of organic dye as tracer is one of the most common methods of detecting micro leakage *in vitro* and it was used in our study.

The latest development in dentin adhesion is based on simplification and reduced application time. This led to the introduction of Dyad flow in which no separate bonding protocols are required. Selfetching adhesives do not require a separate acid-etch-step as they condition and prime enamel and dentin simultaneously by infiltrating and partially dissolving the smear layer and hydroxyapatite to generate hybrid zone, which plays a major role in adhesion. In total etch method, phosphoric acid etches the enamel and removes the smear layer, helps deeper penetration of resin monomers and formation of longer tags providing durable marginal seal [23]. Self-etch systems contain ester monomers with grafted carboxylic or phosphate acid groups dissolved in water. With these systems,

the smear layer is dissolved and incorporated into the hybrid layer. The bonding mechanism for strong self-etch adhesives is very similar to that of etch-and-rinse systems. Their bond strength, particularly for all-in-one systems, is relatively low, probably because of their high initial acidity and high water content [23]. Clearfil SE Bond is a mild two-step self-etch adhesive with a pH very close to 2 [24].

In this study, the results showed greater microleakage scores at the cervical margins compared to the occlusal margins. In 3M ESPE Adper, occlusally 80% samples showed no microleakage and 20% samples showed dye penetration less than $\frac{1}{2}$ of axial wall while cervically 50% samples showed no microleakage; 40% samples showed dye penetration less than $\frac{1}{2}$ of axial wall and 10% showed dye penetration more than $\frac{1}{2}$ of axial wall i.e score 2 (Figure 1).

Similarly with Clearfil SE; occlusally 20% samples no microleakage and 80% samples showed dye penetration less than $\frac{1}{2}$ of axial wall compared to cervical margin where 40% samples showed no microleakage; 40% samples showed dye penetration less than $\frac{1}{2}$ of axial wall and 20% samples showed dye penetration more than $\frac{1}{2}$ of axial wall (Figure 2). However this difference was not statistically significant.

Flowable composites contain dimethacrylate resin and inorganic fillers with a particle size of 0.4 to 3.0 μm and



Figure 1. Microleakage in total-etch method
Slika 1. Mikrocurenje kod primene total-etch tehnike



2a



2b

Figure 2. Microleakage in self-etch method: a) occlusal – 1, cervical – 3; b) occlusal – 0, cervical – 2

Slika 2. Mikrocurenje kod primene samonagrizajuće tehnike: a) okluzalno – 1, gingivalno – 3; b) okluzalno – 0, gingivalno – 2

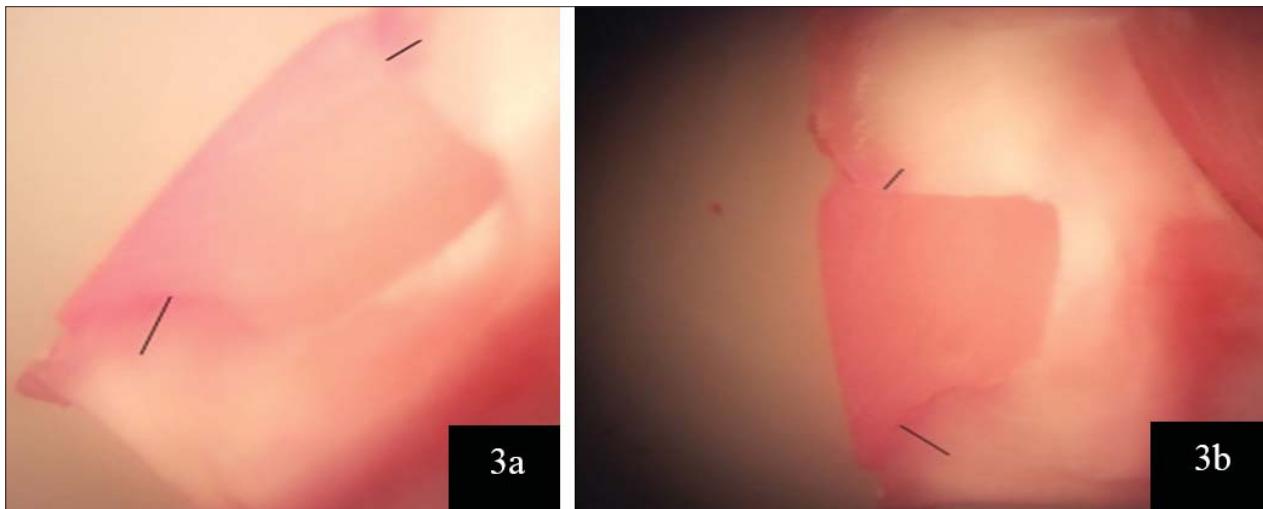


Figure 3. Microleakage in Dyad Flow: a) occlusal – 2, cervical – 3; b) occlusal – 2, cervical – 3

Slika 3. Mikrocurenje kod primene Dyad Flow: a) okluzalno – 2, gingivalno – 3; b) okluzalno – 2, gingivalno – 3

filler loading of 42% to 53% by volume. Recently, self-adhesive flowable composites have become available. Flowable composites have a low modulus of elasticity, which may make them useful in cervical abfraction areas. Because of their lower filler content, they exhibit higher polymerization shrinkage and lower wear resistance than universal composites. The viscosity of these composites allows them to be dispensed by a syringe with a needle tip for easy handling [23].

Also Dyad Flow without acid etching and bonding agent showed the highest microleakage scores than other groups (Figure 3). Our study showed that in Dyad Flow group occlusally 30% samples showed no microleakage and 70% samples showed dye penetration in less than $\frac{1}{2}$ of axial wall; cervically 10% samples showed no microleakage, 40% samples showed dye penetration less than $\frac{1}{2}$ of axial wall and 40% samples showed dye penetration more than $\frac{1}{2}$ of axial wall and 10% samples showed dye penetration spreading along the axial wall. In this group statistically significant difference was observed between microleakage at cervical and occlusal margins. This is in accordance with previous studies that reported poorer bonding to dentin compared to enamel due to higher organic component, tubular structure and lower surface energy of dentin [15]. Also, previous studies reported that no flowable material can completely eliminate microleakage due to higher polymerization shrinkage and coefficient of thermal expansion [25, 26]. As manufacturers launch new self adhesive flowable composites before the conclusion of independent ongoing studies, efforts toward future research should be directed to assess the quality and reliability of these materials through both laboratory and clinical evaluations.

CONCLUSION

In class V restorations restored with composite resin, the choice of material affects the microleakage and retention of the restoration. Within the limitations of this *in vitro* study, it may be concluded that in class V cavities the

application of acid etching provided better occlusal and cervical marginal sealing. All tested adhesives showed a certain amount of microleakage in enamel and dentin. At both enamel and dentin margins, total etch adhesive performed better than other groups. At the apical margin, Dyad Flow showed greater leakage than the other groups.

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Evaluacija mikrocurenja novih tečnih kompozita (*Dyad Flow*) i adheziva baziranih na *total-etch* i samonagrizajućoj tehnići kod V klase kompozitnih ispuna

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KRATAK SADRŽAJ

Uvod Cilj ovog istraživanja je bio da se proceni sposobnost marginalnog zaptivanja novih Dyad Flow tečnih kompozita i dva adhezivna sistema, *total-etch* i samonagrizajućeg sistema, na koronarnom i gingivalnom zidu V klase kompozitnih ispuna.

Materijal i metode rada Standardna V klasa (3 mm meziostalne širine, 3 mm okluzo-gingivalne visine i 1,5 mm dubine) ispreparisana je na vestibularnoj strani sveže ekstrahovanih intaktnih ljudskih zuba. Okluzalni i gingivalni zid preparacije su se nalazili u gledi, odnosno cementu/dentinu. Zubi su metodom slučajnog izbora raspoređeni u tri grupe od po 10 zuba, a ispreparisani kaviteti su zatvoreni različitim kompozitnim materijalima prema instrukcijama proizvođača: grupu A su činili ispuni od nanohibridnih kompozita primjenjeni *total-etch* tehnikom, u grupi B kaviteti su bili ispunjeni nanohibridnim kompozitom primenom samonagrizajuće tehnike, a u grupi C kaviteti su ispunjeni samonagrizajućim tečnim kompozitom Dyad Flow. Nakon obrade i poliranja ispuna, zubi su premazani lakom za nokte i uronjeni u boju rodamin B, a nakon toga uzdužno presećeni. Dubina prodiranja boje je procenjena pomoću stereomikroskopa, i to posebno za okluzalni i gingivalni zid ispuna. Rezultati su predstavljeni na skali od 0 do 3. Podaci su analizirani Kraskal-Volosovim, Man-Vitnjievim i Vilkoksonovim testovima ($\alpha=0,05$).

Rezultati Svi uzorci su pokazali manje mikrocurenje na okluzalnom zidu kaviteta u odnosu na gingivalni zid. Na gingivalnom zidu kavitetu Dyad Flow je pokazao veće mikrocurenje u odnosu na druge adhezivne sisteme.

Zaključak Novi tečni kompozit Dyad Flow je pokazao lošiju adhezivnu vezu sa dentinom i gledi u poređenju sa drugim ispitanim adhezivnim sistemima.

Ključne reči: Dyad Flow; *total-etch*; samonagrizajući adhezivni sistem

UVOD

Potraga za idealnim stomatološkim restaurativnim materijalom, koji ima odgovarajuće fizičke, mehaničke i estetske osobine, doveo je do uvođenja svetlosnopolimerizujućih kompozita. Ove smole se široko koriste kao restaurativni materijali za ispune na prednjim i bočnim zubima. U kompozitnim ispunama vremenom se javljaju promene u adhezivnom sloju. Zbog polimerizacijske kontrakcije ovih materijala, dobra veza sa gledi i dentinom je neophodan preduslov za klinički uspeh; u protivnom, dolazi do stvaranja pukotine između ispuna i zuba i samim tim do nekvalitetnog ispuna [1, 2].

Veza između kompozita i gledi je klinički jaka i izdržljiva veza, zato što kiseline, kao što je fosforna kiselina u koncentraciji od 30–40%, nagrizaju gled i dovode do stvaranja mikropoznosti. Posle nagrizanja u nastale mikropukotine prodire monomer i stvara mikromehaničku vezu između smole i zuba [3, 4]. Nasuprot gledi, dentin ostvaruje slabiju vezu s kompozitom zbog tubularne strukture, visokog organskog sadržaja i unutrašnje vlažnosti [5, 6, 7].

Da bi se rešio ovaj problem, uvedeni su različiti adhezivni sistemi. *Total-etch* u dva koraka uključuje nagrizanje i ispiranje zuba u prvom koraku, ali hidrofilni prajmer i hidrofobni bond su kombinovani u jednom preparatu koji se aplikuje u drugom koraku [8, 9]. *Total-etch* tehniku može dovesti do osetljivosti zuba, ali sličan klinički uspeh se postiže konvencionalnom ili pojednostavljenom *total-etch* tehnikom [10, 11]. Samonagrizajući adhezivni sistemi su alternativni način ostvarivanja veze gledi i dentina s kompozitima. Oni ne zahtevaju poseban korak nagrizanja (*etch*) i zasnivaju se na kiselim monomerima koji istovremeno nagrizaju, ali i služe kao prajmer za gled i dentin [8, 12, 13, 14]. Ovaj sistem eliminiše fazu ispiranja i ne zahteva pri-menu bonda u određenim uslovima vlažnosti zbog sopstvenog

sadržaja vode. Na ovaj način pojednostavljenim postupkom se smanjuje mogućnost greške, pa se ova tehnika sve češće prime-njuje [15]. Tečni kompoziti imaju malu viskoznost i materijal su izbora za restauraciju kaviteta V klase. Tečni kompoziti su lakši za upotrebu i samoadaptabilni u poređenju s konvencionalnim restaurativnim kompozitima [16]. Dyad Flow je novi samonagrizajući tečni kompozit koji se jednostavno upotrebljava. On se vezuje samonagrizajućom tehnikom. Ima sposobnost otpuštanja fluorida i dobra estetska svojstva.

Cilj ovog istraživanja je bio da se proceni sposobnost marginalnog zaptivanja novih Dyad Flow tečnih kompozita i dva adhezivna sistema, *total-etch* i samonagrizajućeg sistema. Svi adhezivni sistemi su procenjeni na koronarnom i gingivalnom zidu V klase kompozitnih ispuna.

MATERIJAL I METODE RADA

U studiju je uključeno ukupno 30 ekstrahovanih intaktnih ljudskih zuba koji su čuvani u fiziološkom rastvoru na sobnoj temperaturi 30 dana. Standardni kaviteti V klase (3 mm meziostalne širine, 3 mm okluzo-gingivalne visine i 1,5 mm dubine) ispreparisani su na cementno-gleđnom spoju na vestibularnoj površini svakog zuba.

Zubi su metodom slučajnog izbora svrstani u tri grupe sa po 10 zuba u svakoj grupi. Kaviteti u grupi A su ispunjeni 3M nanohibridnim kompozitom primenom *total-etch* tehnike uz korišćenje 3M Single Bond adheziva. U grupi B kaviteti su ispunjeni 3M nanohibridnim kompozitom primenom samonagrizajućeg adheziva Clearfil. Za kavite u grupi C korišćen je samonagrizajući Dyad Flow tečni kompozit.

Svi kompoziti su bili A2 boje. Postavljeni su slojevito, i to u dva sloja, gde je svaki sloj polimerizovan 20 sekundi prema

uputstvima proizvođača. Za završnu obradu korišćeni su dijamantski boreri i aluminijumoksidni diskovi sa stalnim hlađenjem vazduhom i vodom.

Apeksni otvori korenova su zatvoreni lepljivim voskom; sve spoljne površine zuba su premazane sa dva sloja laka za nokte osim 1 mm oko ispuna i uronjeni u Rodamin B rastvor boje tokom 24 sata. Uzorci su nakon jednog dana isprani tekućom vodom, osušeni, a potom presećeni u vestibulolingvalnom pravcu. Dubina prodora boje duž zidova kaviteta (kako okluzalnog, tako i gingivalnog zida) izmerena je pomoću stereomikroskopa. Rezultati su predstavljeni neparametrijski brojevima od 0 do 3 (Tabela 1).

Za statističku obradu podataka korišćeni su Kraskal–Volisova analiza varijanse i Man–Vitnijev U-test.

REZULTATI

Mikrocurenje je zabeleženo kod svih ispuna i na okluzalnom i na gingivalnom zidu. Kraskal–Volisova analiza varijanse nije pokazala statistički značajnu razliku između *total-etch* i samonagrizajuće tehnike ($p=0,001$). Dyad Flow je pokazao značajano veće mikrocurenje na okluzalnom i gingivanom zidu u odnosu na druge sisteme ($p>0,05$) (Tabela 2, Grafikoni 1 i 2).

DISKUSIJA

Mikrocurenje su Sidu (*Sidhu*) i Henderson (*Henderson*) [17] definisali kao „klinički neprimetan prolaz bakterija, molekula ili jona između zidova kaviteta i ispuna“. Osnovni cilj ispuna je da stvori „savršen“ kontakt i spreči kontaminaciju iz usne duplje. Međutim, mikrocurenje se javlja kod svih ispuna [18].

Mikrocurenje je veoma značajno kada se zid kaviteta V klase nalazi u dentinu i/ili cementu, zato što može dovesti do slabijeg rubnog zatvaranja nego da je zid u gledi, jer je veza između adheziva i dentina mnogo slabija nego između adheziva i gledi [19, 20]. Tokom polimerizacije ispuna može doći do povlačenja ispuna u okluzalnom pravcu, što dovodi do mikrocurenja na gingivalnom zidu [21]. Veća količina organskog sadržaja, tubularna struktura, pritisak tečnosti i manja površinska energija utiču na slabiju vezu adheziva sa dentinom [22].

U našoj studiji mikrocurenje je izmereno za novi materijal Dyad Flow i upoređeno sa *total-etch* i samonagrizajućom tehnikom na okluzalnom i gingivalnom zidu kaviteta V klase. Za merenje mikrocurenja korišćen je rastvor organske boje, što je najčešće korišćena metoda uopšte.

Najnoviji razvoj u dentin-bondingu odnosi se na pojednostavljenje tehnike i skraćenje vremena rada. To je dovelo do uvođenja tečnog kompozita Dyad Flow, koji ne zahteva posebne bonding protokole. Samonagrizajući adhezivni sistemi ne zahtevaju poseban korak nagrizanja i upotrebu prajmera, zato što oni istovremeno infiltriraju i delimično rastvaraju razmazni sloj i hidroksipatit i stvaraju hibridni sloj, koji igra glavnu ulogu u adheziji. U *total-etch* tehnicu fosforna kiselina nagriza gled i uklanja razmazni sloj, pomaže dublje prodiranje smole monomera i formiranje čvršće veze [23]. Samonagrizajući sistemi sadrže estarske monomere sa grupama karboksilne ili fosfatne kiseline koje su rastvorene u vodi. U ovim sistemima razmazni sloj se rastvori i potom postane deo hibridnog sloja. Mehanizam

vezivanja kod jakih samonagrizajućih adheziva je sličan onom kod sistema koji koriste nagrizanje i ispiranje. Njihova snaga vezivanja, posebno za sveobuhvatne sisteme, relativno je niska, verovatno zbog visoke početne kiselosti i visokog sadržaja vode [23]. Clearfil SE Bond je samonagrizajući adheziv koji se koristi u dva koraka i ima kiseli pH blizu 2 [24].

U ovoj studiji rezultati su pokazali veće mikrocurenje na gingivalnom zidu nego na okluzalnom. U 3M Espe Adper, 80% uzoraka nije pokazalo mikrocurenje, a 20% uzoraka je pokazalo prodor boje duž manje od polovine okluzalnog zida, dok kod gingivalnog zida 50% uzoraka nije pokazalo mikrocurenje; 40% uzoraka je pokazalo prodor boje manje od polovine gingivalnog zida, a 10% je pokazalo prodor boje duž više od polovine aksijalnog zida, tj. na ordinarnoj skali to je odgovaralo broju 2 (Slika 1).

Slično je i sa Clearfil SE: na okluzalnom zidu 20% uzoraka nije pokazalo mikrocurenje, a 80% uzoraka je pokazalo prodiranje boje duž manje od polovine okluzalnog zida u odnosu na gingivalni zid, gde 40% uzoraka nije pokazalo nikakvo mikrocurenje, 40% uzoraka pokazalo je prodor boje duž manje od polovine gingivalnog zida, a 20% uzoraka je pokazalo prodor boje više od polovine gingivalnog zida (Slika 2). Međutim, ova razlika nije bila statistički značajna.

Tečni kompoziti sadrže dimetakrilatnu smolu i neorganska punila sa česticama veličine 0,4–3,0 μm i 42–53% zapremine. Nedavno su se na tržištu pojavili samonagrizajući tečni kompoziti. Tečni kompoziti imaju niski moduo elastičnosti, što ih čini pogodnim za postavljane ispuna u cervikalnom delu zuba. Zbog nižeg sadržaja punila, oni pokazuju veću polimerizacionu kontrakciju i nižu otpornost na habanje u poređenju s konvencionalnim kompozitim. Viskoznost ovih kompozita omogućava njihovu aplikaciju pomoću šprica i igle [23].

U našoj studiji Dyad Flow samonagrizajući kompozit je pokazao najveće mikrocurenje u odnosu na druge grupe (Slika 3). U 30% uzoraka nije bilo mikrocurenja, a 70% uzoraka je pokazalo prodor boje duž manje od polovine okluzalnog zida. U 10% uzoraka nije otkriveno mikrocurenje na gingivalnom zidu, u 40% uzoraka boja je otkrivena do manje od polovine gingivalnog zida. Takođe, u 40% uzoraka prodor boje zabeležen je preko polovine dužine gingivalnog zida, dok je u 10% uzoraka prodor boje bio zabeležen duž celog zida. Prodor boje na okluzalnom zidu je statistički značajno bio manji nego na gingivalnom. Ovi rezultati su u skladu s ranijim istraživanjima koji nalaze slabiju vezu kompozita sa dentinom u odnosu na gled zbog veće količine organskih komponenata, tubularne strukture i manje površinske energije dentina [15]. Takođe, ranije studije su pokazale da je kod tečnih kompozita nemoguće eliminisati mikrocurenje zbog veće polimerizacione kontrakcije i koeficijenta termičkog širenja [25, 26]. U ispitivanjima novih materijala treba sprovesti što više laboratorijskih i kliničkih studija, da bi se dobro procenio kvalitet tih materijala.

ZAKLJUČAK

Kod ispuna V klase vrlo je važan odabir kompozita zbog posledičnog mikrocurenja i retencije ispuna. Svi ispitani materijali u našoj studiji su pokazali mikrocurenje. Najbolja veza je ostvarena sa zubom posle nagrizanja zidova ispuna i na okluzalnom i na gingivalnom zidu kaviteta. Na gingivalnom zidu Dyad Flow je pokazao najveće mikrocurenje u odnosu na druge grupe.

Orthodontic Treatment Need in 11-13 Years Old Schoolchildren in Republika Srpska

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SUMMARY

Introduction Need for orthodontic treatment is determined by the severity of specific malocclusion. Orthodontic indices are used to objectively present treatment needs. The most commonly used is the Index of Orthodontic Treatment Need (IOTN). The aim of this study was to determine the need for orthodontic therapy in 11 to 13 years old schoolchildren in Republika Srpska.

Material and Methods 1377 patients, 11 to 13 years old, were included in this study. The examinations were performed in elementary schools, using daylight, flat mirror and two-dimensional orthodontic caliper. Patients were ranked into 5 grades according to the Dental Health Component (DHC) and graded on a scale 1 to 10 for the Aesthetic Component (AC) of the IOTN index.

Results According to the Dental Health Component (DHC), 79.23% of patients needed orthodontic treatment. Little and borderline orthodontic need was present in 27.74% and 24.83% children, respectively, while severe need was present in 19.98% and 6.68% respectively. 20.77% of subjects did not need orthodontic treatment. In regards to the Aesthetic Component (AC) (face appearance related to orthodontic need) little or no treatment was needed in 91.42% of subjects while 6.42% were borderline and 2.16% of subjects had severe relation between orthodontic need and facial appearance.

Conclusion Due to the wide presence of orthodontic irregularities in schoolchildren 11-13 years old in Republika Srpska, it is important to introduce orthodontic indices in clinical practice in order to determine orthodontic treatment needs.

Keywords: IOTN; orthodontic index; need for orthodontic treatment

INTRODUCTION

The aim of modern orthodontics is to enhance patient's life through improvements of functional occlusion and dentofacial aesthetics as well as to decrease psychological discomfort and increase self-confidence. Individual's needs and requests for orthodontic treatment differ according to the cultural and social environment. Urban environment and higher income are correlated with requests for orthodontic treatment since pleasant look enables higher social status [1-4].

In order to objectify need for orthodontic treatment, various methods are used to assess the severity and frequency of irregularities, both in individual cases and epidemiological studies. Malocclusions can be assessed using qualitative or quantitative methods [5, 6]. Qualitative methods are descriptive and do not provide information about the need for orthodontic treatment but mostly describe and classify irregularities. For quantitative measurements and recording of malocclusions, orthodontic indices have become more popular in the recent years. They can provide balanced interpretation and application of different criteria [7, 8, 9]. The best-known and most widely used index is the Index of Orthodontic Treatment Need (IOTN), that has been introduced in 1992 in Great Britain. The IOTN comprises two components: the Dental Health Component (DHC) and the Aesthetic Component

(AC) [10]. DHC is clinical component of dental health of IOTN index. Patients are grouped into five different grades according to the severity of orthodontic irregularity with every grade precisely defined [10, 11]. AC is based on Evans' and Shaw's standard aesthetic scale (Standardized Continuum of Aesthetic Need – SCAN). It comprises illustrated scale with ten points (groups) and represents subjective perception of dental aesthetics [10, 12].

The aim of this study was to determine the need for orthodontic therapy in 11 to 13 years old schoolchildren in Republika Srpska.

MATERIAL AND METHODS

The representative sample of 11- to 13-year-old children from schools in Republika Srpska was included in this study. The sample was chosen according to the data of Ministry of Education and Culture of Republika Srpska for schoolchildren of these ages in all municipalities. From all children, two staged stratified cluster sample that involved 1377 children 11- to 13-year-old was selected. Research included municipalities of Republika Srpska: Banja Luka, Bijeljina, Doboj, Istočno Sarajevo and Trebinje. Within each region random classes were included in the study.

Clinical examination was performed at school's premises, using daylight, flat mirror and two-dimensional

orthodontic caliper. First part was related to the Dental Health Component (DHC) and second part to the Aesthetic Component (AC) of the IOTN index.

According to the health part of the index, occlusal anomalies were grouped into five grades according to the effect they have on oral health. The biggest effect on oral health had crowding, deep bite, crossbite, distal bite and missing teeth. Based on clinical examination subjects were categorized into one of five groups: DHC 1 – no need for treatment; DHC 2 – little need for treatment; DHC 3 – borderline need for treatment; DHC 4 – great need for treatment; DHC 5 – severe need for treatment.

Second part of examination included grading teeth composition in a smile compared to the reference scale of 10 standard front face photographs. Comparison was done based on teeth composition not just similarity with the photo. This part of research actively involved patients as they rated the appearance of their teeth. These grades were grouped into three categories based on the need for orthodontic therapy in relation to this component of the index: grades 1–4 – little or no need; 5–7 – borderline; 8–10 – great need for therapy.

In order to achieve required statistical strength the sample consisted of 1377 pupils. Based on the aforementioned, a weight for each region was established. Weight is a coefficient assigned to every observed participant in the research, in order to obtain results valid for the whole population. Based on the exact number of 11- to 13-year-old schoolchildren provided by the Ministry of Education and Culture of Republika Srpska the representative sample and a weight were formed based on well-defined attributes. For this research, the weight was determined as the ratio of the number of examined children in a school class within each region and total number of children that attended all school classes in a given region. Based on this way defined weight, results were presented for the whole population. All results were statistically significant.

Qualitative data were presented through frequency and percentage, while statistical strength was determined by standard error for proportions and 95% confidence interval. Quantitative data were presented by basic descriptive statistic measures (mean value, standard error, 95% confidence interval, median value, first and third quartile as well as minimum and maximum).

RESULTS

According to the severity of orthodontic irregularity and need for orthodontic treatment all tested subjects were classified in five grades of DHC. The number of subjects per grade according to this component is presented in Table 1. The highest number of children was classified in group 2 (27.74%) and the lowest was in group 5 (6.39%).

According to the Aesthetic Component (AC), it was determined that 91.42% of patients had no or little need, 6.42% of patients showed borderline need while 2.16% of patients showed great need for orthodontic treatment (Table 2).

Table 1. Number of patients according to the Dental Health Component (DHC) grading system

Tabela 1. Učestalost ispitanika po grupama prema zdravstvenoj komponenti (DHC)

DHC	N	%	SE	95% CI	
				Lower	Upper
DHC 1	2442	20.77	0.0238	16.11	25.43
DHC 2	3262	27.74	0.0229	23.25	32.23
DHC 3	2919	24.83	0.0236	20.21	29.46
DHC 4	2349	19.98	0.0244	15.20	24.76
DHC 5	785	6.68	0.0249	1.79	11.56
Total Ukupno	11756	100.00			

N – number of subjects; SE – standard error; CI – confidence interval

N – broj ispitanika; SE – standardna greška; CI – interval poverenja

Table 2. Need for orthodontic treatment according to the Aesthetic Component (AC) graded by the examiner

Tabela 2. Potreba za ortodontskim lečenjem prema estetskoj oceni (AC) ispitivača

AC	N	%	SE	95% CI	
				Lower	Upper
AC 1–4	10747	91.42	0.0079	89.86	92.97
AC 5–7	755	6.42	0.0256	1.41	11.43
AC 8–10	254	2.16	0.0246	0.00	6.98
Total Ukupno	11756	100.00			

Table 3. Need for orthodontic treatment according to the Aesthetic Component (AC) graded by patients

Tabela 3. Potreba za ortodontskim lečenjem prema estetskoj oceni (AC) ispitanika

AC	N	%	SE	95% CI	
				Lower	Upper
AC 1–4	10925	92.93	0.0072	91.52	94.34
AC 5–7	714	6.07	0.0256	1.05	11.09
AC 8–10	118	1.00	0.0222	0.00	5.36
Total Ukupno	11756	100.00			

Grades assigned by patients followed the grades assigned by examiner, but they were less critical. According to the Aesthetic Component (AC) graded by patients, there was little or no need present in 92.93% of patients, borderline need in 6.07% and great need for orthodontic treatment in 1.00% of children (Table 3).

Aesthetic grade assigned by patients was on average higher than the one graded by the examiner in children that were classified in grades 1 and 2, while in other grades grade given by the examiner was on average higher than given by patients (Table 4).

DISCUSSION

The Dental Health Component (DHC) of the IOTN index is the main indicator of the need for orthodontic treatment. By analyzing this component one can obtain data about distribution of malocclusions, as well as the severity of malocclusion. Orthodontic irregularities are widely distributed so the biggest importance is given to the DHC

Table 4. Average Aesthetic Component (AC) determined by the examiner and patient compared to Dental Health component (DHC)
Tabela 4. Prosečne estetske ocene (AC) ispitivača i ispitanika prema zdravstvenoj komponenti (DHC)

DHC	AC	\bar{X}	SE	Min	Q_1	Q_2	Q_3	MAX	95% CI
DHC 1	Examiner Ispitivač	1.22	0.0084	1	1	1	1	2	1.20 - 1.23
	Patient Ispitanik	1.57	0.0148	1	1	1	2	4	1.55 - 1.60
DHC 2	Examiner Ispitivač	2.34	0.0143	1	2	2	3	5	2.31 - 2.37
	Patient Ispitanik	2.37	0.0175	1	2	2	3	6	2.34 - 2.41
DHC 3	Examiner Ispitivač	2.98	0.0181	1	2	3	3	7	2.94 - 3.01
	Patient Ispitanik	2.72	0.0212	1	2	3	3	9	2.68 - 2.76
DHC 4	Examiner Ispitivač	3.69	0.0339	1	3	3	4	8	3.62 - 3.75
	Patient Ispitanik	3.22	0.0310	1	2	3	4	9	3.16 - 3.28
DHC 5	Examiner Ispitivač	4.59	0.0931	1	3	4	6	10	4.41 - 4.77
	Patient Ispitanik	3.71	0.0693	1	2	3	5	10	3.57 - 3.84

\bar{X} – mean value; SE – standard error; Min – Minimum value; Q_1 – first quartile;

Q_2 – median; Q_3 – third quartile

\bar{X} – aritmetička sredina; SE – standardna greška; Min – najmanja vrednost;

Q_1 – prvi kvartil; Q_2 – medijana; Q_3 – treći kvartil

grades 4 and 5 where there is a need for orthodontic treatment in order to prevent damaging orofacial health. In the current research, 26.66% of patients were determined as grades 4 and 5 indicating that in total >3000 of 11- to 13-year-old children in Republika Srpska need orthodontic treatment. Similar results were obtained in the study of Perillo et al. [13], who examined 12-year-olds in Italy and found the DHC grade 4 and 5 in 27.3% of children. Souames et al. [14] in France among 12-year-olds found 21.8% and Manzanera et al. [15] in Spain for children ages 9 to 12 found 21% of them needed orthodontic treatment. In Germany Tausche et al. [16] came to similar results (21.5%), but in younger children, age 6 to 8 years.

In other research conducted in Europe, these values were somewhat higher when compared to the current study. In Great Britain Brook and Shaw [10] found that 32.7% of 11- and 12-year-olds needed orthodontic treatment. Similar results were presented by Burden [17] in Northern Ireland with 36%, and Josefsson et al. [18] in Sweden with 37% of 12- and 13-year-olds that needed orthodontic correction of malocclusion.

Various authors outside of Europe performed similar research among children age 11 to 14 in Turkey, Japan and Iran. Uçuncü and Ertugay [19] in Turkey found that 38.8% of children needed orthodontic treatment. Watanabe et al. [20] in Japan came to similar results (34.1%), while in Iran Hedayati et al. [21] came to significantly lower values of 18.4%. In Jordan and Malaysia researchers conducted research among 12- and 13-year-olds. Hamdan [22] reported that 31% of Jordan children needed orthodontic treatment, while Abdullah and Rock [23] selected 47.9% of Malaysian patients in this category. Dias et al. [24] performed research in Brazil among 405 children age 9 to 12 and classified 34.2% of children in the DHC groups 4 and 5.

Main role of the Aesthetic Component (AC) of the IOTN index is to determine the association between the face appearance and orthodontic irregularity. Manzanera et al. [15] graded 12-year-olds in Spain as follows: 1–4 little or no need for treatment 85.4%, 5–7 borderline need 10.2% and 8–10 great need for treatment in 4.4% of patients. Souames et al. [14] reported similar grades regarding aesthetics among children age 9 to 12 in France. They found grades 1–4 with little to no need for treatment in 75% of children; grades 5–7 with borderline need in 18% and 7% in grades 8–10 with great need for orthodontic treatment.

In Italy, Nobile et al. [25] conducted research among children age 11 to 14 where they compared the AC grades by the examiner and by patients, similar to the current research. They came to the following results: grades 1–4 with little or no need examiners found in 77.8% and patients in 91.5% of cases, grades 5–7 with borderline need in 13.6% by examiner and in 5.4% by patients and grades 8–10 with great need for treatment in 8.6% by examiner and 3.2% by patients. Based on these results, they came to conclusion that professional dental opinion was significantly more critical than patients' opinion. Linder-Aron [11] came to the same conclusion in Sweden as well as Abdullah and Rock [23] among subjects in Malaysia.

Tauche et al. [16] in their research of children age 6 to 8 in Germany came to significantly different results. Grades 1–4 with little or no need for treatment were found in 34%, grades 5–7 with borderline need in 44.5% and grades 8–10 with great need for treatment in 21.5% of patients. Holmes [26], Crowther et al. [27] and Souames et al. [14] suggested that AC should not be applied in children with mixed dentition as some "temporary" orthodontic irregularities may be corrected in time during the most pronounced growth period by eliminating bad habits (sucking thumbs, tongue pushing, mouth breathing). Due to these reasons there are high values for orthodontic treatment need when AC is applied in children with mixed dentition.

CONCLUSION

Orthodontic irregularities are common among children in Republika Srpska. More than one quarter of patients needed urgent orthodontic treatment in order to prevent further degradation of their orofacial system's health. Conducting periodic epidemiological studies and applying orthodontic indices is of great importance for planning and implementing prevention, as well as organizing dental health service.

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Potreba za ortodontskim lečenjem kod dece uzrasta od 11 do 13 godina u Republici Srpskoj

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KRATAK SADRŽAJ

Uvod Potreba za ortodontskom terapijom se procenjuje na osnovu težine određene malokluzije. Objektivizacija problema potrebe za ortodontskim lečenjem se analizira uvođenjem ortodontskih indeksa. Najpoznatiji takav indeks je indeks potrebe za ortodontskom terapijom (engl. *Index of Orthodontic Treatment Need – IOTN*). Cilj ovog rada je bio da se utvrdi potreba za ortodontskom terapijom kod dece uzrasta 11–13 godina u Republici Srpskoj.

Materijal i metode rada Pomoću IOTN kod 1.377 ispitanika uzrasta od 11 do 13 godina procenjivana je potreba za ortodontskim lečenjem. Pregledi su obavljeni u prostorijama osnovnih škola pri dnevnom svetlu i pomoću ravnog ogledala i dvokrakog ortodontskog šestara. Ispitanici su svrstani u pet grupa prema zdravstvenoj komponenti (DHC) i ocenjeni sa 10 ocena estetske komponente (AC) IOTN.

Rezultati Prema DHC, 79,23% ispitanika imalo je potrebu za ortodontskim lečenjem. Mala i srednja potreba zabeležena je kod 27,74%, odnosno 24,83% dece, dok je velika i veoma velika potreba utvrđena kod 19,98%, odnosno 6,68% dece. Ispitanika kojima nije bila potrebna ortodontska terapija bilo je 20,77%. U pogledu narušenosti izgleda ortodontskom nepravilnošću, ustanovljeno je da je prema AC malu ili nikakvu potrebu za terapijom imalo 91,42% ispitanika, srednju potrebu 6,42%, a veliku potrebu 2,16% dece.

Zaključak Zbog velike rasprostranjenosti ortodontskih nepravilnosti u Republici Srpskoj, veoma bi bilo značajno da se u kliničkoj praksi primenjuju ortodontski indeksi, kako bi se na osnovu takvih analiza mogli odrediti prioriteti u lečenju.

Ključne reči: IOTN; ortodontski indeks; potreba za ortodontskom terapijom

UVOD

Cilj savremene ortodoncije je unapređenje života pacijenta poboljšanjem funkcionalne okluzije i dentofacialnog estetskog izgleda, čime se utiče i na njegovo psihološko rasterećenje i samopouzdanje. Potreba i zahtev pojedinca za ortodontskom terapijom se razlikuje u različitim kulturnim i socijalnim krugovima. Gradska sredina i viši prihodi porodice su u korelaciji sa zahtevom za lečenje, jer prijatan izgled omogućava bolji društveni i socijalni status [1-4].

Da bi se problem potrebe za ortodontskim lečenjem objektivizao, uvedene su različite metode za procenu težine i učestalosti određenih nepravilnosti, koje se mogu koristiti za pojedinačne slučajeve, ali i u svrhe epidemioloških istraživanja. Evidentiranje malokluzija može biti kvalitativno i kvantitativno [5, 6]. Kvalitativne metode su deskriptivne i ne pružaju informaciju o potrebi za ortodontskom terapijom, već više opisuju i klasifikuju nepravilnosti u grupe. Za kvantitativna merenja i evidentiranja malokluzija u poslednje vreme se sve više koriste indeksi koji služe kao pokazatelji određenog stanja ili proporcionalni odnos koji se može izvesti kroz niz zapažanja. Korišćenje indeksa treba da osigura ujednačeno tumačenje i primenu kriterijuma [7, 8, 9]. Najpoznatiji i najčešće korišćen je indeks potrebe za ortodontskim terapijom (engl. *Index of Orthodontic Treatment Need – IOTN*), koji se od 1992. godine prvenstveno koristi u Velikoj Britaniji. IOTN se sastoji od dve komponente: zdravstvene (engl. *dental health component – DHC*) i estetske (engl. *aesthetic component – AC*) [10]. DHC je klinička, odnosno komponenta dentalnog zdravlja IOTN. Pomoću ovog dela indeksa pacijenti se prema izraženosti ortodontske nepravilnosti svrstavaju u pet različitih grupa s tačno određenim graničnim vrednostima [10, 11]. AC se zasniva na Evansovoj (*Evans*) i Šawovoj (*Shaw*) standardnoj estetskoj skali (engl. *standardized continuum of aesthetic need – SCAN*). Ona se sastoji od ilustrovane

skale sa deset stepeni (grupa) i predstavlja estetski kriterijum subjektivnog doživljaja dentalne estetike [10, 12].

Cilj ovog rada je bio da se utvrdi potreba za ortodontskom terapijom kod dece uzrasta od 11 do 13 godina u Republici Srpskoj.

MATERIJAL I METODE RADA

Podaci u ovom istraživanju su prikupljeni na osnovu uzorka koji je kreiran tako da bude reprezentativan za svu decu od 11 do 13 godina koja pohađaju osnovne škole u Republici Srpskoj. Okvir uzorka činili su podaci Ministarstva prosvete i kulture Republike Srpske o učenicima ovog uzrasta osnovnih škola u svim opštinama Republike Srpske. Iz ovog okvira urađen je dvoetapni stratifikovani klaster uzorak, tako da je u istraživanje bilo uključeno 1.377 dece uzrasta 11–13 godina. Regije koje su zastupljene u ovom istraživanju, a koje obuhvataju sve opštine Republike Srpske, bile su Banja Luka, Bijeljina, Dobojski, Istočno Sarajevo i Trebinje. Unutar svake regije nasumično su izabrani razredi u školama u kojima su pregledani svi učenici.

Klinički pregled je obavljan u prostorijama škola, pri dnevnom svetlu i pomoću ravnog stomatološkog ogledala i dvokrakog ortodontskog šestara. Prvi deo se odnosio na zdravstvenu komponentu (DHC), a drugi na estetsku komponentu (AC) IOTN.

Prema zdravstvenom delu indeksa, okluzalne anomalije su svrstane u pet kategorija prema uticaju koji imaju na oralno zdravlje. Smatra se da najveći uticaj na oralno zdravlje imaju teskoba, dubok zagrižaj, ukršteni zagrižaj, distalni zagrižaj i nedostatak zuba, tako da se ocena daje na osnovu najtežeg kliničkog nalaza. Na osnovu kliničkog nalaza ispitanici su svrstani u jednu od pet grupa: DHC 1 – nema potrebe za lečenjem; DHC 2 – mala potreba za lečenjem; DHC 3 – srednja potreba za lečenjem; DHC 4 – velika potreba za lečenjem; DHC 5 – veoma velika potreba za lečenjem.

Drugi deo pregleda sastojao se od ocenjivanja odnosa zuba pri osmehu poređenjem sa skalom od 10 standardnih fotografija lica spreda, pri čemu se ocenjivao izgled zuba, a ne sličnost s fotografijom. U ovom delu ispitivanja aktivno su učestvovali i svi ispitanici tako što su sami ocenjivali izgled svojih zuba. Ove ocene su grupisane u tri kategorije prema potrebi za ortodontskom terapijom u odnosu na ovu komponentu indeksa: ocena 1–4 – mala ili nikakva; ocena 5–7 – srednja; ocena 8–10 – velika potreba za terapijom.

Da bi se postigla dovoljna statistička snaga, u uzorak je uključeno 1.377 učenika. Na osnovu opisanog izbora kreirani su i ponderi unutar svake regije. Ponder je koeficijent koji se dodeljuje svakoj jedinici posmatranja, odnosno svakom ispitaniku u istraživanju, s ciljem dobijanja rezultata za čitavu populaciju, a ne samo za posmatrani uzorak. Na osnovu preciznih podataka Ministarstva prosветe i kulture o broju dece uzrasta 11–13 godina koja pohađaju osnovne škole u Republici Srpskoj, formiran je reprezentativan uzorak, a kasnije i ponder pomoću dobro definisanih obeležja koja određuju glavne karakteristike ispitanika. U ovom istraživanju ponder je određen kao odnos broja ispitivane dece u pojedinom razredu škole unutar pojedine regije i ukupnog broja dece koja pohađaju sve razrede u svim školama unutar te regije. Na osnovu ovako definisanog pondera, u statističkoj analizi su rezultati prikazani za čitavu populaciju. Svi rezultati dobijeni na ovaj način su statistički značajni.

Kvalitativni podaci su predstavljeni kroz učestalost i procentualni ideo, a statistička snaga ovih rezultata je proverena ocenom standardne greške za proporcije i 95-procentni interval poverenja (95% CI). Kvantitativni podaci su prikazani osnovnim pokazateljima deskriptivne statistike: aritmetička sredina (\bar{X}), standardna greška (SE), 95% CI, mediana (Med), prvi i treći kvartil, te najmanja vrednost (Min) i najveća vrednost (Max).

REZULTATI

Ispitanici su prema stepenu izraženosti ortodontske nepravilnosti i potrebi za ortodontskom terapijom svrstani u pet grupa DHC. Raspodela ispitanika po grupama prema ovoj komponenti prikazana je u tabeli 1. Najveći broj dece bio je u grupi 2 DHC (27,74%), a najmanji u grupi 5 (6,39%).

Prema AC, ustanovljeno je da je kod 91,42% ispitanika prisutna mala ili nikakva potreba, kod 6,42% srednja, a kod 2,16% velika i veoma velika potreba za ortodontskim lečenjem (Tabela 2).

Ocene ispitanika prate ocene ispitivača, ali su manje kritične. Prema AC ispitanika o potrebi za ortodontskom terapijom, ustanovljeno je da malu ili nikakvu potrebu imalo 92,93%, srednju potrebu 6,07%, a veliku i veoma veliku potrebu za terapijom 1,00% dece (Tabela 3).

Estetska ocena ispitanika je u proseku bila veća od ocene ispitivača kod dece koja su u grupama 1 i 2, dok je u ostalim grupama bila veća prosečna estetska ocena ispitivača (Tabela 4).

DISKUSIJA

Zdravstvena komponenta (DHC) IOTN je glavni pokazatelj potrebe za ortodontskom terapijom. Analizom ove komponente dobijaju se podaci o rasprostranjenosti malokluzija, kao i stepenu njihove izraženosti. Rasprostranjenost ortodontskih ne-

pravilnosti je veoma velika, pa se najveći značaj pridaje 4. i 5. DHC grupi s velikom i veoma velikom potrebom za terapijom, kojima je lečenje neophodno da bi se zaustavilo narušavanje zdravlja celog stomatognatog sistema. U ovom istraživanju je utvrđeno da je 26,66% ispitanika pripadalo ovim dvema grupama, što ukazuje na to da je kod više od 3.000 dece uzrasta od 11 do 13 godina u Republici Srpskoj neophodna ortodontska terapija. Ovi nalazi su najsličniji rezultatima do kojih su došli Perilo (Perillo) i saradnici [13] u svome istraživanju u Italiji među dvanaestogodišnjacima, pri čemu je ova vrednost bila 27,3%. Nešto niže vrednosti (21,8%) zabeležene su u istraživanju Suama (Souames) i saradnika [14] u Francuskoj takođe među dvanaestogodišnjacima, i Manzanere (Manzanera) i saradnika [15] u Španiji među decom uzrasta 9–12 godina (21%). U Nemačkoj je Tauševa (Tausche) sa saradnicima [16] došla do sličnih rezultata (21,5%), ali je istraživanje urađeno među mlađim ispitanicima uzrasta od šest do osam godina.

U drugim istraživanjima evropskih autora ove vrednosti su bile nešto veće nego u našem istraživanju. Tako su u Velikoj Britaniji Bruk (Brook) i Šo (Shaw) [10] ustanovili da 32,7% jedanaestogodišnjaka i dvanaestogodišnjaka ima veliku ili veoma veliku potrebu za ortodontskim lečenjem. Slične rezultate su dobili i Burden (Burden) [17] u Severnoj Irskoj (36%) i Jozefson (Josefsson) i saradnici [18] u Švedskoj (37%), koji su istraživanje obavili među decom uzrasta od 12 i 13 godina.

Slične studije su izvodili i autori u zemljama van Evrope. Istraživanje među decom uzrasta od 11 do 14 godina su urađena u Turskoj, Japanu i Iranu. Učunku (Uçuncü) i Ertugaj (Ertugay) [19] u Turskoj su među 550 dece ovog uzrasta ustanovili da 38,8% njih ima veliku i veoma veliku potrebu za terapijom. Watanabe (Watanabe) i saradnici [20] u Japanu došli su do sličnih rezultata (34,1%), dok su u Iranu Hedajati (Hedayati) i saradnici [21] dobili značajno niže vrednosti za ovu grupu (18,4%). U Jordanu i Maleziji su istraživači izveli istraživanje o potrebi za ortodontskom terapijom među decom uzrasta 12–13 godina. Hamdan (Hamdan) [22] je ustanovio da 31% jordanske dece ovoga uzrasta ima veliku i veoma veliku potrebu za ortodontskom terapijom, dok su Abdulah (Abdullah) i Rok (Rock) [23] u ovu grupu svrstali 47,9% malezijskih ispitanika. Dijas (Dias) i saradnici [24] su među 405 brazilske dece uzrasta 9–12 godina u 4. i 5. DHC grupu svrstali 34,2% ispitanika.

Glavna uloga AC IOTN jeste da se oceni u kojoj meri je izgled lica narušen ortodontskom nepravilnošću. Tako su, u pogledu ovog parametra, Manzanera i saradnici [15] kod dvanaestogodišnjaka u Španiji dali sledeće ocene: 1–4 mala ili nikakva potreba za terapijom – 85,4% dece, 5–7 srednja potreba – 10,2% dece, i 8–10 velika potreba – 4,4% ispitanika. Slične ocene u odnosu na estetiku dali su i Suam i saradnici [14] u okviru svog istraživanja među decom uzrasta 9–12 godina u Francuskoj. Tako je u njihovom istraživanju 75% dece dobilo ocene 1–4, 18% ocene 5–7, a 7% ocene 8–10.

U Italiji su Nobile (Nobile) i saradnici [25] izveli istraživanje među decom uzrasta 11–14 godina u kojem su poredili AC ocene ispitivača i ispitivane dece, slično kao u našem istraživanju. Tako su došli do sledećih rezultata: ocene 1–4 ispitivač je dao u 77,8% slučajeva, a ispitanici u 91,5%, ocene 5–7 u 13,6% slučajeva, a deca u 5,4%, a ocene 8–10 kod 8,6% ispitanika, a deca kod 3,2%. Na osnovu ovih rezultata zaključili su da je stručno stomatološko mišljenje znatno kritičnije od mišljenja ispitanika u vezi s narušenošću estetike lica ortodontskom nepravilnošću.

Do istog zaključka su došli i Lindner-Arson (*Lindner-Arson*) [11] među ispitanicima u Švedskoj i Abdulah i Rok [23] među ispitanicima u Maleziji.

Taušeova i saradnici [16] su u okviru svoga istraživanja među decom uzrasta od šest do osam godina u Nemačkoj došli do značajno drugačijih rezultata nego u prethodnim istraživanjima. Ona na sledeći način ocenjuje estetiku u pogledu zastupljene ortodontske nepravilnosti: ocene 1–4 kod 34%, ocene 5–7 kod 44,5% i ocene 8–10 kod 21,5% ispitanika. Holms (*Holmes*) [26], Krauter (*Crowther*) i saradnici [27] i Suam i saradnici [14] smatraju da AC ne treba primenjivati kod dece s mešovitom denticijom, jer se veoma često neke tzv. privremene ortodontske nepravilnosti koriguju vremenom, tokom perioda najvećeg rasta i razvoja i prekidanjem loših navika (sisanje prsta, tiskanje jezika i disanje na usta). Upravo iz ovih razloga se javljaju visoke

vrednosti ocena za potrebu za ortodontskom terapijom, ako se AC primenjuje kod dece s mešovitom denticijom.

ZAKLJUČAK

Kod dece u Republici Srpskoj zabeležena je velika rasprostranjenost ortodontskih nepravilnosti. Više od četvrtine ispitanice populacije ima veoma veliku i hitnu potrebu za ortodontskim lečenjem kojim bi se sprečilo dalje narušavanje zdravlja njihovog stomatognatog sistema. Izvođenje periodičnih epidemioloških istraživanja pomoću ortodontskih indeksa, kao i njihovo uvođenje u kliničku praksu, bilo bi veoma značajno za planiranje i primenu mera prevencije, kao i za organizovanje zdravstvene stomatološke službe.

Music As an Alternative Therapy Method in Dentistry

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SUMMARY

Dental fear represents a significant social concern. Therefore, an individual approach to each patient and timely recognition and elimination of dental stress are necessary in order to provide adequate and successful treatment. The aim of this paper was to present possible application of music therapy in dentistry and its role in reducing dental fear. Music has shown great prospective as an alternative therapy method in various fields of medicine. Music therapy is painless and noninvasive anxiolytic method that reduces dental anxiety as it provides relaxation and distraction. Music in dental office creates positive atmosphere among patients and their company as well as dental staff.

Keywords: dental fear; music therapy; dental office

INTRODUCTION

Music is omnipresent in human culture and has been deeply woven into the fabric of everyday life regardless of race, age, social and economic status and ethnic origin. Music helps expressing personal feelings and establish contacts with other people. Importance of music and its positive effect on health originates from centuries before Christ, which has been documented in ancient papers of Chinese medicine and Indian Samaveda [1, 2]. Pythagoras, the sixth-century Greek philosopher who is considered as founder of music therapy, believed that music has an overall positive influence on body as well as on psyche creating a unique harmony between them [3]. In the past years, music therapy has become more popular and has been applied during various medical procedures (surgical interventions, intensive care, cancer treatment, psychiatry, cardiology, therapy of pre-operative anxiety) [4].

Fear of dental procedures is still a significant social problem. Therefore, an individual approach to each patient and timely recognition and elimination of dental stress are necessary in order to provide adequate and successful treatment. Diseases, injuries, hospitalization and dental treatments are often stressful and as such, they can have negative influence on cardiovascular, neuroendocrine and immune system. They can impede recovery or trigger complications. [5, 6]. Prevalence of dental anxiety is estimated at 6–15% of the world's adult population, and in children the prevalence ranges between 5.7% and 19.5% [7]. Anxious patient does not fully cooperate with dental practitioner. Such situation prolongs the procedure and makes it more difficult. As a result, elimination of patient's anxiety may improve the quality, effectiveness and success of dental treatment – and hence improve overall health of patients [1]. It is proved that anxious patients need 20% more time for dental treatment compared to patients who cooperate adequately (probably because of

frequent interruptions during the treatment) [8]. It has also been shown that patients with severe dental fear, in the months after the dental treatment, have increased prevalence of flu and cold [9].

The aim of this article was to present possible application of music therapy in dentistry and its role in reducing dental fear.

MUSIC THERAPY

Music is an art form with main elements: pitch, rhythm, dynamics and sound characteristics such as timbre and resonance. Application of music for anxiety reduction is usually called *music relaxation, audio-analgesia or audio anxiolysis* [10]. Music with relaxation effect is usually called anxiolytic music and most often includes compositions characterized by slow tempo, repetitive rhythmic patterns, predictable dynamics and constant harmony [11, 12].

Music can influence emotions, intellect and psyche. Music therapy can be active or passive. Active music therapy (per Munro and Mount) includes controlled use of music in order to achieve psychological, physiological and emotional integrity during treatment [13]. This therapy is performed by specially trained musicians, professional music therapists who work in hospitals, clinics, schools, rehabilitation centers and who use various music techniques (listening, singing, playing instruments, composing music and moving with music) [4]. Passive music therapy is passive listening to pre-recorded music without direct involvement of music therapist.

Some studies indicate that active music therapy in medicine is significantly more effective than passive music listening [14, 15]. This difference can be attributed to the fact that active music therapy individualizes its intervention to meet patient's specific needs. [14]. Cook [16]

in her paper stated that dentists were one of the leading proponents of music therapy, using it to promote relaxation and pain control for their patients. Passive music listening which has audio-analgesic, anxiolytic or sedation effects may be applied independently or with pharmacological (anesthesia and analgesia) or non-pharmacological therapy (suggestion, relaxation techniques, hypnosis, acupuncture, meditation,...) [17].

THERAPEUTIC EFFECTS OF MUSIC

Music has overall positive influence on body and psyche since it stimulates emotions, motivates, renews memories and soothes [18]. Music increases the level of creativity and optimism, contributes to positive feelings and prevents depression and anxiety. The importance of sense of hearing is confirmed by the fact that it is developed before the sense of sight in embryonic stage and it is the first functional sense in human life [4]. Sound is not limited by time and space; therefore, in the form of impulse, it reaches nervous system easily and influences brain waves changing physiological and psychological condition of an individual [19]. Music easily reaches all parts of brain and activates them by creating new and more complex connections and bypassing damages in the existing cell connections. Music uses rhythm to change neural activity in lateral temporal lobe and cortical area that control movements and triggers expression of opioid receptor morphine-6-glucuronide and interleukin 6 [5]. In addition, other significant effects of music therapy are increased level of excreted immunoglobulin and decreased serum cortisol level [20].

It is well-known that certain music can have positive influence on concentration, patience and significantly reduce anxiety [21]. Such changes in brain activity under the influence of music overcome certain problems, even when the music stops. In addition, music has an impact on autonomous nervous system (heart rate and breathing), since it reduces blood pressure, increases immunity, decreases muscle tension and pain intensity. Studies of music therapists show that music with pronounced rhythm stimulates brain waves to adopt the same rhythm. When the rhythm gets faster, pulse and breathing get increased as well. This improves concentration and makes thinking process faster which can be used to improve physical performance. Slow music rhythm soothes and relaxes resulting in slower breathing and decreased heart rate and overall relaxation [4]. Simultaneously, music influences physiological and psychological condition of an individual [22]. It has been shown that listening to music for therapeutic anxiolytic purposes leads to changes in automatic and central nervous system causing positive physiological reactions of patients [23].

Music theorists Bonny, Gfeller and Guzzetta state that music has the ability to distract and divert attention away from stressful stimuli and promote feelings of physical and mental relaxation by refocusing attention on pleasurable emotional state and blocking unpleasant environmental sounds [4].

MUSIC AND DENTAL ANXIETY

Dental anxiety is often caused by unpleasant sounds in dental office, but music can mask such sounds and have direct influence on pain reduction [17, 24]. Music can, with the use of auditory distractions and activation of large number of neurotransmitters, divert attention and eliminate feelings of pain and fear [25]. Many factors cause anxiety and fear in dental office, but sense of losing control due to unfamiliar situation and environment is definitely one of the most significant factors [26]. Listening to familiar and preferred music also helps patients to regain sense of control [27]. It is believed that pain control may block paths to brain receptors by music and as a result reduce pain perception and necessary doses of analgesics [28, 29]. Such application of music is often called *white noise* effect, and it implies playing the music before the procedure starts.

Effect of music on patients during various medical procedures has been studied from various aspects [30]. Anxiety especially relates to patients that undergo painful and stressful medical and dental procedures [31]. Anxiolytic effects of music have been studied for the last 20 years during different medical treatments (surgical, cardiac, oncologic and other patients) [4, 31, 32].

In 1981, Parkin [33] studied the effect of music on reducing anxiety level among children by playing 5-minute ambience music prior to dental treatment. Students who listened to music in stressful situations marked lower levels of excreted cortisol, while students who did not listen to music marked significantly higher levels [33]. In 2005, Cooke et al. [34] reported relaxing effect of music by focusing mental and physical attention toward some other pleasant emotional state. Some researchers indicated that soothing music leads to relaxation and attention distraction, which reduces neuroendocrine activity and sympathetic nervous system resulting in decrease of fear, heart and respiratory rate, blood pressure [30, 35]. According to the studies of Olszewska and Źarow [21], patients who were listening to music during dental treatment showed: lower level of tension, better approachability and adjustment to all types of treatments. Music had a positive influence on fear and comfort during intervention, especially among patients with moderate and high level of anxiety, regardless of patient's sex and age [21]. Tran et al. [36] conducted a survey in 2010 among patients and dental professionals on preferred anxiolytic interventions during dental treatment. It has been confirmed that 89% of patients and dental professionals prefer listening to ambient music during dental interventions.

However, efficient application of music during dental treatment may be compromised by the use of inadequate music [30]. Therefore, it is necessary and very important that patients listen to familiar and preferred music during medical procedure (if possible, a patient should choose music) [30]. Researchers also indicate that music genre used to achieve a desirable effect differs since it is a unique experience for each person and depends on many factors: sex, age, attitudes, culture, personal traits or current mood [17, 37]. Intensive stimulation by excessively

loud sounds might even aggravate pain while extremely soft sound might increase anxiety [37].

Despite large number of studies on the effect of music during various medical treatments, research related to the application of music during dental treatments is still vague [38]. Different results are usually consequence of various studies and individual factors such as music taste, age, sex, patient's culture etc. Therefore, individual characteristics such as health condition, level of awareness, pain tolerance and personality itself, environment, musical knowledge and previous music experience, have the most important role in the effectiveness of music during various therapy procedures.

CONCLUSION

Music has significant positive potential as an alternative therapy method in various fields of medicine. Music therapy is painless and noninvasive anxiolytic method and when compared to pharmacological and other treatments it does not require great investments in training or equipment. Music significantly reduces dental anxiety with its soothing or distracting effects. Therefore, music therapy is cheap, easily accessible and not demanding anxiolytic method for everyday dental practice. Music in waiting rooms and dental offices creates positive atmosphere for patients, their company and dental professionals.

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Muzika kao alternativna terapijska metoda u stomatologiji

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KRATAK SADRŽAJ

Strah od stomatološke intervencije je i danas značajan društveni problem, pa su zato neophodni individualni pristup svakom pacijentu i pravovremeno prepoznavanje i eliminacija dentalnog stresa, kako bi se realizovala odgovarajuća i uspešna terapija. Cilj ovog rada je bio da ukaže na mogućnosti primene muzikoterapije u stomatologiji i predstavi njene efekte u eliminaciji dentalne anksioznosti. Muzika ima značajan pozitivan potencijal kao alternativna terapijska metoda u raznim poljima medicine. Muzikoterapija je bezbolna i neinvazivna anksiolitička metoda koja smanjuje dentalnu uznenirenost svojim opuštajućim ili efektom skretanja pažnje. Muzika u stomatološkoj ordinaciji stvara pozitivnu atmosferu pacijentima, njihovoj prati, ali i stručnom osoblju.

Ključne reči: dentalni strah; muzikoterapija; stomatološka ordinacija

UVOD

Muzika je sveprisutna u ljudskoj kulturi i od davnina je duboko utkana u svakodnevni život, bez obzira na rasu, godine, socio-ekonomski status i etničko poreklo. Muzika pomaže u izražavanju sopstvenih osećanja i ostvarivanja kontakata sa drugim ljudima. Verovanja u značaj muzike i njen povoljan uticaj na zdravlje potiču vekovima pre nove ere, što je dokumentovano u spisima o staroj kineskoj medicini i u drevnoj indijskoj Samaveda knjizi [1, 2]. Pitagora, grčki filozof iz šestog veka, koji se smatra ocem muzikoterapije, verovao je da muzika ima sveobuhvatan pozitivan uticaj kako na telo, tako i na psihu, stvarajući pri tome jedinstvenu harmoniju [3]. Poslednjih godina terapija muzikom postaje sve popularnija i primenjuje se u različitim medicinskim procedurama (operacije, intenzivna nega, terapija raka, psihijatrija, kardiologija, terapija preoperacione anksioznosti itd.) [4].

Strah od stomatološke intervencije je i danas značajan društveni problem, pa su zato neophodni individualni pristup svakom pacijentu i pravovremeno prepoznavanje i eliminacija dentalnog stresa, kako bi se realizovala odgovarajuća i uspešna terapija. Bolest, povrede, hospitalizacija i stomatološko lečenje su vrlo često stresogeni, što može nepovoljno uticati na kardiovaskularni, neuroendokrini i imunski sistem, te time oslabiti oporavak bolesnika, odnosno pospešiti pojavu komplikacija [5, 6]. Procenjuje se da se dentalna anksioznost javlja kod 6–15% odraslih osoba u svetu, dok je kod dece u rasponu od 5,7% do 19,5% [7]. Uznenireni pacijent ne sarađuje potpuno sa stomatologom, čime se produžava vreme i otežava izvođenje dentalne procedure, pa eliminacija uznenirenosti stomatoloških pacijenata poboljšava kvalitet, efikasnost i uspeh stomatološkog lečenja, utičući time na pacijentovo opšte zdravlje [1]. Utvrđeno je da anksiozni pacijenti zahtevaju oko 20% više vremena za stomatološki tretman u odnosu na pacijente koji adekvatno sarađuju (verovatno zbog češćih prekida tokom rada) [8]. Dokazano je takođe da pacijenti s težim stepenom dentalnog straha u mesecima koji slede posle stomatološkog lečenja imaju povećanu prevalenciju gripe i prehlade [9].

Cilj ovog rada bio je da ukaže na mogućnosti primene muzikoterapije u stomatologiji i predstavi njene efekte u eliminaciji dentalne anksioznosti.

MUZIKOTERAPIJA

Muzika je umetnost čiji su osnovni elementi ton, ritam, dinamika i osobine zvuka kao što su boja i punoća. Primena muzike za ublažavanje anksioznosti se najčešće naziva „opuštanje uz muziku“, „audio-analgezija“ ili „audio-anksioliza“ [10]. Muzika s opuštajućim efektom se naziva anksiolitička i najčešće obuhvata kompozicije sporog tempa, ponavljajućeg ritma, predvidljive dinamike i konsonantne harmonije [11, 12].

Muzika može uticati na emocije, intelekt i psihu, a ova terapija može biti aktivna ili pasivna. Aktivna terapija muzikom, po Munrou (Munro) i Mauntu (Mount), podrazumeva kontrolisano korišćenje muzike kako bi se postigao psihološki, fiziološki i emocionalni integritet tokom tretmana [13]. Ovu terapiju izvode specijalno obučeni muzičari, profesionalni muzikoterapeuti, koji rade u bolnicama, klinikama, školama, rehabilitacionim centrima i koriste razne muzičke tehnike (slušanje, pevanje, sviranje, stvaranje muzike i kretnje uz muziku) [4]. Pasivna terapija muzikom podrazumeva pasivno slušanje ranije snimljene muzike od strane terapeuta i bez učešća muzikoterapeuta.

Neka istraživanja pokazuju da aktivna muzička terapija u medicini ima statistički značajno više dejstva od intervencije uz pasivno slušanje muzike [14, 15]. Razlika može biti uzrokovana činjenicom da aktivna muzikoterapija individualizuje intervenciju sa specifičnim pacijentovim potrebama [14]. Kuk (Cook) [16] u svom radu navodi da su stomatolozi izraziti zagovornici muzikoterapije za relaksaciju i kontrolu bola pacijenata. Pasivno slušanje muzike u funkciji audio-analgetika, anksiolitika ili sedativa može se primenjivati samostalno ili uz farmakološku, (anestezija i analgezija) ili nefarmakološku terapiju (sugestija, relaksacione tehnike, hipnoza, akupunktura, meditacija) [17].

TERAPIJSKI EFEKTI MUZIKE

Muzika ima sveobuhvatan pozitivan uticaj na telo i psihu, jer podstiče emocije, motiviše, obnavlja sećanja i smiruje [18]. Muzika podiže nivo kreativnosti i optimizma, doprinosi pozitivnim osećanjima i tako štiti od depresije ili anksioznosti. Značaj sluge se potvrđuje u činjenici da se razvija pre vida u embrionalnom stadijumu, i to je prvo funkcionalno čulo u životu čoveka [4]. Za zvuk ne postoje ograničenja u vremenu i granice u prostoru, te vrlo lako u formi impulsa dolazi do nervnog sistema i utiče na

moždane talase menjajući fiziološko i psihološko stanje pojedinca [19]. Muzika lako dolazi do svih delova mozga i aktivira ih stvarajući nove i složenije veze, odnosno premoščava oštećenja u već postojećim čelijskim vezama. Ona svojim ritmom može menjati neuralnu aktivnost u lateralnom temporalnom režnju i u kortikalnoj oblasti zaduženoj za pokret, pri čemu dovodi do ekspresije opijate receptora morfin-6-glukuronida i interleukina 6 [5]. Pozitivne fiziološke promene, kao što je povećanje nivoa izlučenog imunoglobulina, odnosno smanjenje nivoa kortizola u serumu, takođe su značajni efekti muzikoterapije [20].

Poznato je da određena muzika može imati pozitivan uticaj na koncentraciju, strpljenje i značajno smanjenje uznemirenosti [21]. Ove promene moždane aktivnosti pod uticajem muzike olakšavaju savladavanje određenih problema čak i kada se završi slušanje muzike. Muzika utiče i na autonomni nervni sistem (na rad srca i disanja), jer smanjuje krvni pritisak, pojačava imunitet, smanjuje napetost mišića i doživljaj intenziteta bola. Istraživanja muzikoterapeuta pokazuju da muzika izraženog ritma stimuliše moždane talase da rezonuju u istom ritmu. Ubrzanjem ritma muzike ubrzavaju se i puls i disanje, te dolazi do pojačanja koncentracije i bržeg razmišljanja, što se može iskoristiti za poboljšanje učinka u fizičkoj aktivnosti. Sporiji muzički ritam relaksira i smiruje, a usporenjem disanja i smanjivanjem brzine rada srca dolazi do opuštanja [4]. Muzika istovremeno utiče i na fiziološko i na psihološko stanje pojedinca [22]. Dokazano je da slušanje muzike u terapijske anksiolitičke svrhe dovodi do promena u automatskom i centralnom nervnom sistemu, izazivajući pozitivne fiziološke reakcije pacijenata [23].

Theoretičari muzike Boni (*Bonny*), Gfeler (*Gfeller*) i Guzeta (*Guzzetta*) smatraju da muzika ima mogućnost skretanja pažnje sa stresnih stimulusa i da utiče na fizičku i mentalnu relaksaciju, fokusirajući se na prijatna emotivna stanja i blokirajući neprijatne zvukove u okolini [4].

MUZIKA I DENTALNI STRES

Dentalni strah je često uzrokovani neprijatnim zvucima u stomatološkoj ordinaciji, a upravo muzika može maskiranjem tog zvuka direktno uticati na smanjenje bola [17, 24]. Muzika može auditivnim ometanjem i aktiviranjem velikog broja neurotransmitera dovesti do skretanja pažnje i eliminacije osećaja bola i straha [25]. Mnogo je faktora koji izazivaju napetost i strah u stomatološkoj ordinaciji, ali je osećaj gubitka kontrole zbog nepoznate situacije i okruženja sigurno jedan od najvažnijih [26]. Slušanje poznate ili željene muzike takođe pomaže pacijentima da povrate osećaj kontrole [27]. Smatra se da se kontrolom bola putevi prema receptorima u mozgu mogu blokirati muzikom i time smanjiti percepcija bola, ali i doze neophodnih analgetika [28, 29]. Ovakva primena muzike se često naziva efektom „bele buke“, a podrazumeva uključenje muzike pacijentima obavezno pre početka tretmana.

Efekat muzike na pacijente tokom različitih medicinskih procedura je ispitivan s različitim aspekata [30]. Anksioznost se posebno odnosi na pacijente koji moraju da se podvrgnu bolnim i stresnim medicinskim i stomatološkim zahvatima [31]. Anksiolitički efekat muzike je proučavan poslednjih 20 godina u različitim studijama i kod različitih medicinskih tretmana (hirurških, kardioloških, onkoloških i drugih) [4, 31, 32].

Parkin (*Parkin*) [33] je 1981. godine proučavao efekat muzike na smanjenje anksioznosti kod dece u vidu petominutnog slušanja ambijentalne muzike pre stomatološkog lečenja. Kod učenika koji su slušali muziku je u stresnim situacijama zapažen niži nivo izlučenog kortizola, dok je kod učenika koji nisu slušali muziku taj nivo bio znatno viši [33]. Kuk (*Cooke*) i saradnici [34] su 2005. godine dokazali opuštajući efekat muzike, zahvaljujući mentalnom i fizičkom preusmeravanju pažnje prema nekom ugodnom emotivnom stanju. Neki istraživači su pokazali da umirujuća muzika opušta i odvraća pažnju, čime smanjuje aktivnost neuroendokrinog i simpatičkog nervnog sistema, što dovodi do smanjenja straha, srčanog ritma, respiratornog ritma i krvnog pritiska [30, 35]. Prema istraživanjima Olsevske (*Olszewske*) i Žarova (*Žarow*) [21], pacijenti koji su slušali muziku tokom stomatološkog zahvata su pokazali niži nivo tenzije, veću pristupačnost i bolju prilagodljivost svim vrstama tretmana. Muzika je pozitivno uticala na strah i komfor tokom intervencije, posebno kod pacijenata sa srednjim i visokim nivoom uznemirenosti, bez obzira na pol i starost pacijenta [21]. Tran (*Tran*) i saradnici [36] su 2010. godine sprovedli anketu kod stomatološkog osoblja i pacijenata o prioritetnim anksiolitičkim intervencijama tokom dentalnog tretmana. Potvrđeno je da 89% pacijenata i stomatoloških stručnjaka više voli slušanje ambijentalne muzike tokom stomatološke intervencije.

Međutim, efikasnost primene muzike tokom dentalnog tretmana može biti narušena puštanjem neodgovarajuće muzike [30]. Zato je neophodno da pacijenti slušaju poznatu i poželjnu muziku tokom medicinske procedure (po mogućству da je sam pacijent izabere) [30]. Istraživači takođe pokazuju da se vrsta muzike koja se koristi za postizanje željenog efekta razlikuje od osobe do osobe, jer je ona jedinstveno iskustvo za svaku osobu i zavisi od mnogih faktora: pola, starosti, stavova, kulture, osobina ličnosti, trenutnog raspoloženja [17, 37]. Intenzivna stimulacija upotrebo prekomerne jačine zvuka može čak da pogorša bol, dok previše mekan zvuk može pojačati uznemirenost [37].

Uprkos velikom broju istraživanja o uticaju muzike na različite medicinske tretmane, rezultati o njenom uticaju na dentalni tretman su i danas prilično nejasni [38]. Razlike u rezultatima su najčešće posledica različitih studija i individualnih faktora, kao što su muzičke sklonosti, starost, pol, kultura pacijenata itd. Dakle, individualne karakteristike, poput zdravstvenog stanja, nivoa budnosti, tolerancije bola i same ličnosti, životne sredine, poznavanja muzike i prethodnog muzičkog iskustva, imaju najvažniju ulogu u efektima muzike u različitim terapijskim procedurama.

ZAKLJUČAK

Muzika je značajan pozitivan potencijal kao alternativna terapijska metoda u raznim poljima medicine. Muzikoterapija je bezbolna i neinvazivna anksiolitička metoda i, za razliku od farmakoloških i drugih tretmana, ne zahteva velika ulaganja u obuku ili opremu. Muzika značajno smanjuje dentalnu uznemirenost svojim opuštajućim ili efektom skretanja pažnje. Muzikoterapija je, dakle, jeftina, lako dostupna i nezahtevna anksiolitička metoda za svakodnevnu stomatološku praksu. Muzika u čekaonicama i stomatološkoj ordinaciji stvara pozitivnu atmosferu pacijentima, njihovoj pratnji, ali i stručnom osoblju.

Effectiveness of Serbian Health Care System in 2014

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SUMMARY

The European Health Consumer Index (EHCI) is a project that since 2006 has been comparing and ranking health care systems of European countries, from the perspective of patients (consumers) - users of the health care system. Its purpose was to set standards for well functioning and organized health care. The aim of this study was to assess the state of Serbian health care system from the perspective of the European health consumer index and propose recommendations for its improvement and functioning in accordance with European standards. The assessment of the health care system is based on pre-determined forty-eight indicators divided into six groups. According to these indicators, scoring and ranking of countries was done (maximum score for a particular indicator was 3, and the minimum was 1). As per European Health Consumer Index the Republic of Serbia is ranked at 33rd place, with total of 473 points, while Netherlands has been found on the top of the list for years (this year 898 points).

Keywords: health system; European Health Consumer Index; indicators of the health system

INTRODUCTION

Due to medical advances people are expected to live longer and in the case of diseases to receive the most effective medications as well as necessary diagnostic and medical procedures, both in detection and treatment of disease. Throughout the Europe the incidence of chronic diseases is on the rise and, consequently financial burden related to health care. There is a growing concern of politicians and health experts that existing health systems might not be able to respond to the growing demands of health care. Most countries are now reforming their health care systems in the direction of putting the patient in the focus of health care, trying to preserve and improve functioning of their health systems with less allocation of public funds.

The European Health Consumer Index (EHCI) is a project that had started in 2006 and since then its goal is to compare and rank health systems of European countries, from the perspective of patients (consumers) – users of the health care system with basic aim to set standards for well-functioning and organized health care. In 2014 there were 36 countries included in EHCI estimation, among them was the Republic of Serbia.

The aim of this study was to assess the state of Serbian health care system from the perspective of EHCI compared to neighbouring countries and countries of the European Union and propose recommendations for its improvement and functioning in accordance to European standards.

INDICATORS OF THE HEALTH CARE SYSTEM EFFICIENCY

The assessment of health care system was made on the basis of pre-determined forty-eight indicators, divided into six groups:

- The first group included indicators that describe the rights of patients and their awareness;
- The second group of indicators assessed the availability of health care (waiting times for the treatment);
- The third group of indicators evaluated the outcomes of the treatment;
- The fourth group observed the range and scope of services provided in health care;
- The fifth group assessed prevention;
- The sixth group assessed pharmaceuticals use.

Based on the indicators scoring and ranking of countries was done, where the highest score for a given indicator was 3 and the lowest 1. The resulting points were multiplied by a coefficient determined for each group of indicators, so that the total sum amounted 1000. The score in each individual group is shown in the Table 1.

Table 1. Relative weight of the six observed groups presented in scores

Tabela 1. Relativni značaj šest posmatranih grupa predstavljenih bodovima

Group Grupa		Maximum scores Maksimalni broj bodova
I	Patient rights and information Prava pacijenata i njihova informisanost	150
II	Accessibility of health care Pristupačnost zdravstvene zaštite	225
III	Outcomes of the treatment Ishodi lečenja	250
IV	Range and reach of services Spektar i dostupnost usluga	150
V	Prevention Prevencija	125
VI	Pharmaceuticals Lekovi	100
Total Ukupno		1000

The current study compared the health care system of the Republic of Serbia with health care systems of the neighbouring countries (Croatia, Montenegro, Macedonia, Bulgaria, Albania and Slovenia) and highly developed countries of European Union with the highest scores (Italy, Spain, Netherlands).

Group I – Patients' rights and their awareness were evaluated by the following indicators:

1. Healthcare law based on Patients' Rights
2. Patient organisations involved in decision making
3. No-fault malpractice insurance
4. Right to second opinion
5. Access to own medical record
6. Registry of bona fide doctors
7. Web or 24/7 telephones HC info with interactivity
8. Cross-border care financed from home
9. Provider catalogue with quality ranking
10. EPR penetration
11. Patients' access to on-line booking of appointments?
12. e-prescriptions

In connection to the rights of patients and their awareness, the highest score was achieved by Netherlands (35) and Macedonia (33) which with this indicator stood out not only from the other countries in the region, but also from Italy (25) and Spain (23). In this segment only Bul-

garia (19) had lower score than Serbia (20). Table 2 shows that out of former Yugoslav Republics, only Macedonia achieved excellent results in most indicators about rights and patients' awareness.

Serbia showed low score (20 points) but it is on the right track. However, there is room for improvement in:

- patients' involvement in health policy through raising their awareness
- establishing a registry of conscientious physicians and catalog-ranked health providers
- accessing to electronic patient record at the entire territory, provide phone scheduled appointments to physicians and availability of electronic prescriptions.

Group II – Accessibility to health care (waiting for treatment) was assessed by the following indicators:

1. Family doctor same day access
2. Direct access to Specialist
3. Major elective surgery <90 days
4. Cancer therapy < 21 days
5. CT scan < 7days
6. A&E waiting Times

As it can be seen from Table 3, Macedonia was the best in assessing the availability of health services in 2014 with 17 points, Spain with eight points was the weakest. Serbia scored only one point more than Spain, and eight points less

Table 2. Patient rights and their awareness in 2014

Tabela 2. Prava pacijenata i njihova informisanost u 2014. godini

Indicator Pokazatelj	Srbija Srbija	Slovenija Slovenija	Croatia Hrvatska	Montenegro Crna Gora	Makedonija Makedonija	Albania Albanija	Bulgaria Bugarška	Netherlands Holandija	Italy Italija	Spain Španija
Healthcare law based on patients' rights Zdravstveni zakon zasnovan na pravima pacijenata	3	3	3	2	3	3	1	3	3	3
Patient organisations involved in decision making Organizacije pacijenata	2	2	2	1	3	3	3	3	2	1
No-fault malpractice insurance Osiguranje od greške u lečenju	2	2	1	2	2	1	1	3	2	1
Right to second opinion Pravo na drugo mišljenje	2	2	3	3	3	2	1	3	2	2
Access to own medical record Pristup svom zdravstvenom kartonu	2	2	2	3	3	3	2	3	2	2
Registry of bona fide doctors Registar savesnih lekara	1	2	2	1	3	3	3	3	3	1
Web or 24/7 telephone health care info with interactivity 24-časovni telefon za zdravstvenu pomoć	2	2	1	2	3	1	1	3	3	3
Cross-border care seeking financed from home Međugrađana nega finansirana od strane zemlje u kojoj je osoba državljanin	2	1	1	2	2	2	1	3	1	1
Provider catalogue with quality ranking Katalog pružalaca usluga s ocenama	1	1	1	1	2	1	1	3	2	1
Electronic personal record penetration Dostupnost elektronskog kartona pacijentu	1	2	3	2	3	1	3	3	2	2
Patients' access to on-line booking of appointments? Mogućnost online zakazivanja posete lekaru	1	3	3	1	3	1	1	2	2	3
E-prescriptions Elektronski recepti	1	1	3	1	3	1	1	3	1	3
Total Ukupno	20	23	25	21	33	22	19	35	25	23

1 – weak; 2 – good or incomparable; 3 – excellent
1 – slab; 2 – dobro ili neuporedivo; 3 – odlično

Table 3. Accessibility (waiting times for treatment) in 2014**Tabela 3.** Dostupnosti zdravstvene službe (čekanje na lečenje) u 2014. godini

Indicator Pokazatelj	Serbia Srbija	Slovenia Slovenija	Croatia Hrvatska	Montenegro Crna Gora	Macedonia Makedonija	Albania Albanija	Bulgaria Bugarska	Netherlands Holandija	Italy Italija	Spain Španija
Family doctor same day access Poseta lekaru opšte medicine istog dana	3	3	3	2	3	3	3	3	3	1
Direct access to specialist Direktni dolazak do specijaliste	1	3	2	1	2	3	2	1	2	1
Major elective surgery <90 days Čekanje na velike izabrane operacije manje od 90 dana	1	1	1	1	3	3	3	3	2	1
Cancer therapy <21 days Čekanje na terapiju za kancer manje od 21 dan	1	3	3	2	3	2	2	2	2	2
CT scan <7 days Čekanje na CT skener manje od 7 dana	1	2	1	1	3	2	1	3	1	1
A&E waiting times Čekanje na prijem u hitnu službu	2	2	3	3	3	3	2	3	1	2
Total Ukupno	9	14	13	10	17	16	13	15	11	8

1 – weak; 2 – good or incomparable; 3 – excellent

1 – slab; 2 – dobro ili neuporedivo; 3 – odlično

than Macedonia, with availability of health services considerably weaker than Albania (16), Netherlands (15), Slovenia (14), Croatia (13) and Bulgaria (13). Access to health care is very important indicator in assessing the ability of health care system to meet the needs of population.

In order for Serbian health services to become more accessible, it is necessary to determine objective and subjective reasons for difficult access to specialists as well as necessary diagnostic, operational procedures and therapy. Macedonia could serve as an example to Serbia how to improve availability of health services (with possibility of same day access to family doctor) (score 3).

Group III – The third set of indicators evaluated treatment outcomes through the following indicators:

1. Decrease of CVD (cardiovascular diseases) deaths
2. Decrease of stroke deaths
3. Infant deaths
4. Cancer survival
5. Preventable Years of Life Lost
6. MRSA (Methicillin-resistant *Staphylococcus aureus*) infections
7. Abortion rates
8. Depression

Treatment outcomes, as the most important indicators for well functioning health care system, clearly distinguished economically stronger countries such as Netherlands (23), Spain (19), Italy (16) and Slovenia (15), from our neighbouring countries. Netherlands leads with twenty-three points in this category, with nearly three times more points than Serbia as the last one (8). Outcomes of treatment were also somewhat better in Croatia (15) Montenegro (15), followed by Bulgaria (12), Albania (10) and Macedonia (10) (Table 4).

Devastating output effects of the Serbian health care system, with no single parameter that achieved good or

excellent score, suggests need for serious reform of the health care system. Ten years of reforming health care system, with large financial investments through various projects and donations has not produced progress in any of indicators.

In the following period these questions should be answered:

- Why is Serbia so much behind other European countries and countries in the region?
- Why such large investments in reforming the health care system have not produced the expected effects?
- Is economic inferiority of the country the main reason for poor output effects in the functioning of health care system?

Group IV – The fourth group assessed the range and scope of services provided by the following indicators:

1. Equity of health care systems
2. Cataract operations per 100 000 people age 65+
3. Kidney transplants per million of population
4. Is dental care included in the public healthcare offering?
5. Informal payments to doctors
6. Long term care for elderly
7. % of dialysis done outside of clinic
8. Caesarean Sections

In the fourth group which evaluated the range and scope of services provided in the health care system, the highest score was awarded to Netherlands (24), followed by Spain (18), Slovenia (18), Croatia (16), Macedonia (15) and Italy (14) with the least points achieved by Albania and Bulgaria (9). The range and scope of services provided in Serbia were assessed with 11 points, slightly more than Albania and Bulgaria (Table 5). Indicator five (informal payments to doctors) showed clearly corruption problem in countries of the region, and a small number of kidney

transplantations. The number of kidney transplantations demonstrates again the best results in the Netherlands and Spain, and from countries in the region good results are only in Croatia.

Compliment to Serbian health care system is slightly higher percentage of dialysis undertaken out of the clinics in comparison to all other countries in the region. This shows the consistency of the policy shift towards satisfying the needs of population with cheaper and more effective methods of treatment.

Table 4. Treatment outcomes in 2014

Tabela 4. Ishodi lečenja u 2014. godini

Indicator Pokazatelj	Serbia Srbija	Slovenia Slovenija	Croatia Hrvatska	Montenegro Crna Gora	Macedonia Makedonija	Albania Albanija	Bulgaria Bugsarska	Netherlands Holandija	Italy Italija	Spain Španija
Decrease of cardiovascular diseases deaths Smanjenje smrtnosti od kardiovaskularnih bolesti	1	3	1	1	1	1	3	3	2	2
Decrease of stroke deaths Smanjenje smrtnosti od moždanog udara	1	2	2	3	1	1	1	3	2	3
Infant deaths Smrtnost odojčadi	1	3	3	2	1	1	1	3	3	3
Cancer survival Preživljavanje kod obolelih od kancera	1	2	1	1	1	1	1	2	2	2
Preventable years of life lost Izgubljene godine života koje mogu da se preveniraju	1	2	2	1	2	2	1	3	3	3
MRSA infections Procenat bolničkih infekcija usled MRSA	1	2	1	2	1	1	2	3	1	1
Abortion rates Procenat abortusa	1	3	3	3	2	2	1	3	2	2
Depression Procenat depresije	1	2	2	2	1	1	2	3	1	2
Total Ukupno	8	19	15	15	10	10	12	23	16	18

1 – weak; 2 – good or incomparable; 3 – excellent

MRSA – Methicillin-resistant Staphylococcus aureus

1 – slabo; 2 – dobro ili neuporedivo; 3 – odlično

MRSA – *Staphylococcus aureus* koji je rezistentan na meticilin

Table 5. Range and reach of services provided in 2014

Tabela 5. Raspon i domet pruženih usluga u 2014. godini

Indicator Pokazatelj	Serbia Srbija	Slovenia Slovenija	Croatia Hrvatska	Montenegro Crna Gora	Macedonia Makedonija	Albania Albanija	Bulgaria Bugsarska	Netherlands Holandija	Italy Italija	Spain Španija
Equity of healthcare systems Pravičnost zdravstvenog sistema	1	2	3	1	3	1	1	3	2	2
Cataract operations per 100,000 age 65+ Broj operacija katarakte na 100.000 stanovnika starijih od 65 godina	1	3	2	2	2	2	1	3	2	2
Kidney transplants per million people Broj transplantacija bubrega na 1.000.000 ljudi	1	1	3	1	1	1	1	3	1	3
Is dental care included in the public healthcare? Uključenost stomatološke zaštite u javnu zdravstvenu zaštitu	2	3	3	2	3	1	2	3	2	2
Informal payments to doctors Neformalna plaćanja doktorima	1	3	1	1	2	1	1	3	3	3
Long term care for the elderly Dugotrajna nega za stariju populaciju	1	2	1	2	1	1	1	3	1	2
Percent of dialyses done outside of clinic Procenat dijaliza urađenih van klinike	2	1	1	1	1	1	1	3	2	2
Caesarean sections per 1,000 newborns Carski rez u odnosu na 1.000 živorođenih	2	3	2	2	2	1	1	3	1	2
Total Ukupno	11	18	16	12	15	9	9	24	14	18

1 – weak; 2 – good or incomparable; 3 – excellent

1 – slabo; 2 – dobro ili neuporedivo; 3 – odlično

Group V – The parameters related to the output effects of prevention:

1. Infant immunization
2. Blood pressure
3. Smoking Prevention
4. Alcohol Prevention
5. Physical Activity
6. HPV Vaccination
7. Traffic deaths

The highest score in this group of parameters achieved Spain (18), followed by Macedonia and Italy with 16 points and Slovenia with 15 points. The lowest score was achieved in Croatia (10). Serbia is somewhere in the middle with 13 points (Table 6). Surprisingly, Macedonia achieved higher score on prevention than Netherlands. Smoking prevention did not yield expected results in any country in the region, not even in the Netherlands. This calls for certain corrections, in order to achieve better efficiency.

In Serbia, there is room for improving output effects of preventive activities by increasing the percentage of vaccinated infants, greater engagement in the prevention of smoking and alcohol consumption, especially in the “National Program for Teens” implementation. Compared to the neighbouring countries Serbia’s highlights are good results of the activities undertaken on physical activity and reduction of high blood pressure among population.

Table 6. Prevention achieved in 2014**Tabela 6.** Preventivne aktivnosti u 2014. godini

Indicator Pokazatelj	Serbia Srbija	Slovenia Slovenija	Croatia Hrvatska	Montenegro Crna Gora	Macedonia Makedonija	Albania Albanija	Bulgaria Bugarska	Netherlands Holandija	Italy Italija	Spain Španija
Infant immunization Vakcinacija odojčadi	2	3	3	2	3	3	2	2	2	3
Blood pressure Visina krvnog pritiska	2	1	1	1	1	1	1	3	3	3
Smoking prevention Prevencija pušenja	1	1	1	1	1	1	1	1	1	2
Alcohol prevention Prevencija alkohola	2	2	2	3	3	3	2	2	3	2
Physical activity Fizička aktivnost	3	3	1	2	3	2	1	1	2	2
HPV vaccination HPV vakcinacija	1	3	1	2	3	1	3	3	3	3
Traffic deaths Smrtnost u saobraćaju	2	2	1	2	2	1	2	3	2	3
Total Ukupno	13	15	10	13	16	12	12	15	16	18

1 – weak; 2 – good or incomparable; 3 – excellent

HPV – human papilloma virus

1 – slabo; 2 – dobro ili neuporedivo; 3 – odlično

HPV – humani papiloma virus

Table 7. Pharmaceuticals use in 2014**Tabela 7.** Korišćenje farmaceutskih proizvoda u 2014. godini

Indicator Pokazatelj	Serbia Srbija	Slovenia Slovenija	Croatia Hrvatska	Montenegro Crna Gora	Macedonia Makedonija	Albania Albanija	Bulgaria Bugarska	Netherlands Holandija	Italy Italija	Spain Španija
Rx pharmaceutical subsidy Ukupna prodaja farmaceutskih proizvoda koji su plaćeni javnim subvencijama	1	2	2	1	3	1	1	3	1	3
Layman-adapted pharmacopoeia Postojanje Lajman-adaptirane farmakopeje dostupne javnosti	3	3	3	2	3	1	3	3	3	2
Novel cancer drugs deployment rate Stopa primene novih lekova za rak	1	2	1	2	2	2	1	2	2	2
Access to new drugs (time to subsidy) Dostupnost novih lekova	2	1	2	2	2	1	2	2	1	1
Arthritis drugs Korišćenje lekova za artritis	1	2	1	2	2	2	1	2	2	2
Metformin use Korišćenje metformina	2	1	2	1	1	2	2	3	2	2
Antibiotics per capita Korišćenje antibiotika po glavi stanovnika	2	3	2	1	2	2	2	3	1	2
Total Ukupno	12	14	13	11	15	11	12	18	12	14

1 – weak; 2 – good or incomparable; 3 – excellent

1 – slabo; 2 – dobro ili neuporedivo; 3 – odlično

Group VI – The sixth group assessed the use of pharmaceuticals through the following indicators:

1. Rx pharmaceutical subsidy
2. Layman-adapted pharmacopoeia?
3. Novel cancer drugs deployment rate
4. Access to new drugs (time to subsidy)
5. Arthritis drugs use
6. Metformin use
7. Antibiotics per capita

In this group of parameters, Netherlands was again at the first place, with total of 18 points achieved followed by Macedonia (15), Spain (14), Slovenia (14) and Croatia (13). The lowest score was achieved by Montenegro and Albania (11) while Italy, Bulgaria and Serbia reached a little bit higher score (12) (Table 7).

In the assessment of indicators and use of pharmaceutical products paid by public subsidies, Serbia received poor marks. The rate of application of specific new concepts and new drugs for the treatment of cancer in Serbia must improve, as well as the use of drugs for arthritis treatment, in order to get closer to European Union countries' standards.

CONCLUSION AND RECOMMENDATIONS

Health care system in Serbia, according to the European Health Consumer index (EHCI), was placed on 33rd place with 473 points out of a maximum 1000. At the top of the list for years is Netherlands with the total of 898 points achieved this year. This ranking and applied parameters, provide clear insight into what is good in health care system of Serbia and what needs to be improved in order to reach the ultimate goal – satisfied and healthy user-consumer of health care system.

Positive developments in Serbia have been made in improving the access to primary health care, information about medicines, increased percentage of dialysis performed outside the clinics, as well as good results of activities undertaken to reduce the high rates of high blood pressure among population.

In order for users of health care in the Republic of Serbia to be healthy and happy with health care system the following parameters should be improved:

- involvement of patients in health policy and increased patients' awareness,
- activities on prevention and promotion,
- activities to reduce adverse treatment outcomes,
- activities to increase access to health care,
- activities to reduce infant mortality,
- activities to reduce the percentage of patients with cancer,
- activities aimed to prevent corruption in health care

Evaluation of Serbian health care system effectiveness from the perspective of EHCI allows us to define recommendations in order to comply with European standards, and ultimately, achieve satisfaction of users/consumers.

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Efikasnost zdravstvenog sistema Republike Srbije u 2014. godini

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KRATAK SADRŽAJ

Evropski zdravstveni potrošački indeks (EHCI) je projekat kojim se od 2006. godine porede i rangiraju zdravstveni sistemi evropskih zemalja iz ugla pacijenata (potrošača) – korisnika zdravstvenog sistema, s osnovnim ciljem postavljanja standarda za dobro funkcionisanje i organizaciju zdravstva. Cilj ovog rada je bio da se proceni stanje srpskog zdravstva iz ugla EHCI i predlože preporuke za njegovo unapređenje i funkcionisanje u skladu s normama evropskih standarda. Procena zdravstvenih sistema je urađena na osnovu unapred određenih 48 pokazatelja, raspoređenih u šest grupa. Na osnovu ovih pokazatelja je urađeno bodovanje i rangiranje zemalja (najveća ocena za određeni pokazatelj bila je 3, a najmanja 1). Republika Srbija je, prema EHCI, zauzela 33. mesto sa 473 boda, dok je na vrhu liste već godinama Holandija (ove godine sa 898 bodova).

Ključne reči: zdravstveni sistem; evropski zdravstveni potrošački indeks; pokazatelji zdravstvenog sistema

UVOD

Zahvaljujući napretku medicine očekuje se da se živi duže, a kada nastupi bolest, da se dobijaju najdelotvorniji lekovi, odnosno da se primene neophodne dijagnostičke i medicinske tehnologije, kako u otkrivanju, tako i u lečenju raznih bolesti. Širom Evrope se s povećanjem životnog veka stanovništva povećava i incidenциja hroničnih bolesti, a samim tim i finansijska opterećenost vezana za zdravstvenu zaštitu. Raste zabrinutost kako političara, tako i zdravstvenih stručnjaka, da postojeći zdravstveni sistemi neće moći da odgovore na sve veće potrebe korisnika zdravstvene zaštite. Većina zemalja pokreće reforme svojih zdravstvenih sistema u pravcu stavljanja pacijenta u fokus zdravstvene zaštite, pokušavajući da sa sve manjim javnim finansijskim sredstvima očuvaju i unaprede funkcionisanje zdravstvenog sistema.

Evropski zdravstveni potrošački indeks (engl. *European Health Consumer Index – EHCI*) je projekat kojim se od 2006. godine porede i rangiraju zdravstveni sistemi evropskih zemalja iz ugla pacijenata (potrošača) – korisnika zdravstvenog sistema, s osnovnim ciljem njegovog dobrog funkcionisanja i organizacije. Ovom procenom je 2014. godine bilo obuhvaćeno 36 zemalja, među kojima je bila i Republika Srbija.

Cilj ovog rada je bio da se proceni stanje srpskog zdravstva iz ugla EHCI, uporedi sa zemljama u okruženju i zemljama Evropske Unije i predlože preporuke za njegovo unapređenje i funkcionisanje u skladu s normama evropskih standarda.

POKAZATELJI EFIKASNOSTI ZDRAVSTVENOG SISTEMA

Procena zdravstvenih sistema je urađena na osnovu unapred određenih 48 pokazatelja, raspoređenih u šest grupa:

- prvu grupu su činili pokazatelji koji govore o pravima pacijenata i njihovoj informisanosti;
- druga grupa pokazatelja ocenila je dostupnost zdravstvene zaštite (čekanje na lečenje);
- treća grupa pokazatelja procenila je ishode lečenja;
- četvrta grupa je posmatrala raspon i domet pruženih usluga u zdravstvenoj zaštiti;
- peta grupa pokazatelja ocenila je prevenciju;
- šesta grupa se bavila procenom korišćenja farmaceutike.

Na osnovu pokazatelja je izvršeno bodovanje zemalja i rangiranje, pri čemu je najveća ocena za određeni pokazatelj bila 3, a najmanja 1. Dobijeni bodovi su pomnoženi utvrđenim koeficijentom za svaku grupu pokazatelja, tako da ukupan zbir iznosi 1.000. Težinska vrednost pojedinih grupa je prikazana u tabeli 1.

U ovom radu je izvršeno poređenje zdravstvenog sistema Republike Srbije sa zdravstvenim sistemima zemalja iz okruženja (Hrvatska, Crna Gora, Makedonija, Bugarska, Albanija i Slovenija), odnosno visokorazvijenim zemljama Evropske Unije s najviše osvojenih bodova (Italija, Španija, Holandija).

I grupa – Prava pacijenata i njihova informisanost su procenjeni na osnovu sledećih pokazatelja:

1. Zdravstveni zakon zasnovan na pravima pacijenata
2. Organizacije pacijenata
3. Osiguranje od greške u lečenju
4. Pravo na drugo mišljenje
5. Pristup svom zdravstvenom kartonu
6. Registrar savesnih lekara
7. 24-časovni telefon za zdravstvenu pomoć
8. Međugrađana nega finansirana od strane zemlje u kojoj je osoba državljanin
9. Katalog pružalaca usluga s ocenama
10. Dostupnost elektronskog kartona pacijentu
11. Mogućnost online zakazivanja posete lekaru
12. Elektronski recepti

Kada je reč o pravima pacijenata i njihovoj informisanosti, najveći broj bodova je ostvarila Holandija (35), a zatim Makedonija (33), koja se ovim pokazateljem izdvaja ne samo od ostalih zemalja u regionu, već i od Italije (25) i Španije (23). U ovom segmentu od Srbije (20) je bila slabija samo Bugarska (19). U tabeli 2 se uočava da je od bivših jugoslovenskih republika samo Makedonija postigla odlične rezultate u većini pokazatelja koji govore o pravima pacijenata i njihovoj informisanosti.

Srbija, iako pretposlednja sa 20 bodova, na dobrom je putu, s tim što je potrebno još da:

- unapredi uključenost pacijenata u zdravstvenu politiku kroz podizanje njihove informisanosti;

- da oformi registar savesnih lekara i katalog rangiranih pružalaca zdravstvenih usluga; i
- da omogući dostupnost elektronskog kartona pacijentu na celoj teritoriji i obezbedi mogućnost telefonskog zakazivanja poseta lekaru, odnosno elektronsku dostupnost recepata.

II grupa – Pristupačnost zdravstvenoj zaštiti (čekanje na lečenje) procenjeno je na osnovu sledećih pokazatelja:

1. Poseta lekaru opšte medicine istog dana
2. Direktan dolazak do specijaliste
3. Čekanje na velike izabrane operacije manje od 90 dana
4. Čekanje na terapiju za kancer manje od 21 dan
5. Čekanje na CT skener manje od sedam dana
6. Čekanje na prijem u hitnu službu

Kao što se iz tabele 3 vidi, Makedonija je sa 17 bodova bila najbolja prilikom ocenjivanja dostupnosti zdravstvene službe u 2014. godini, a Španija sa 8 bodova najslabija. Srbija ima samo jedan bod više od Španije i osam bodova manje od Makedonije (17), a dostupnost zdravstvene službe je znatno slabija i od Albanije (16), Holandije (15), Slovenije (14), Hrvatske (13) i Bugarske (13). Dostupnost zdravstvene zaštite je vrlo važan pokazatelj u proceni sposobnosti zdravstvenog sistema da odgovori potrebama stanovništva.

Da bi zdravstvena služba u Srbiji postala dostupnija, potrebno je utvrditi objektivne i subjektivne razloge zbog kojih se kod nas teško dospeva ne samo do specijaliste, nego i do potrebne dijagnostike, hirurške procedure i terapije. Makedonija može da služi kao primer za unapređenje dostupnosti zdravstvene službe u Srbiji, gde je istoga dana moguća samo poseta lekaru opšte medicine (ocena 3).

III grupa – Ishodi lečenja procenjeni su na osnovu sledećih pokazatelja:

1. Smanjenje smrtnosti od kardiovaskularnih bolesti
2. Smanjenje smrtnosti od moždanog udara
3. Smrtnost odojčadi
4. Preživljavanje kod obolelih od kancera
5. Izgubljene godine života koje mogu da se preveniraju
6. Procenat bolničkih infekcija usled MRSA
7. Procenat abortusa
8. Procenat depresije

Ishodi lečenja, kao najvažniji pokazatelji funkcionalisanja zdravstvenog sistema, jasno odvajaju ekonomski jače zemlje, kao što su Holandija (23), Španija (19), Italija (16) i Slovenija (15), od zemalja iz našeg neposrednog okruženja. Holandija, sa osvojena 23 boda u ovoj kategoriji, ima gotovo tri puta više bodova od poslednje Srbije (8). Ishodi lečenja su takođe bili nešto bolji u Hrvatskoj (15) i Crnoj Gori (15), potom u Bugarskoj (12), Albaniji (10) i Makedoniji (10) (Tabela 4).

Poražavajući izlazni efekti zdravstvenog sistema Republike Srbije, gde ni na jednom parametru nije bilo dobre ili odlične ocene, navode na potrebu ozbiljne reforme zdravstvenog sistema. Deset godina reformisanja zdravstvenog sistema, uz velika

finansijska ulaganja kroz različite projekte i donacije, nije dalo nikakvog pomaka ni u jednom pokazatelju. U narednom periodu bi trebalo odgovoriti na sledeća pitanja:

- Zašto Srbija toliko kaska za ostalim evropskim zemljama, odnosno zemljama iz regionala?
- Zašto tolika projektna ulaganja u reformisanje zdravstvenog sistema nisu dala očekivane rezultate?
- Da li je ekonomski inferiornost zemlje glavni razlog loših izlaznih efekata u funkcionalisanju zdravstvenog sistema?

IV grupa – Raspon i domet pruženih usluga su procenjivani na osnovu sledećih pokazatelja:

1. Pravičnost zdravstvenog sistema
2. Broj operacija katarakte na 100.000 stanovnika starijih od 65 godina
3. Broj transplantacija bubrega na 1.000.000 ljudi
4. Uključenost stomatološke zaštite u javnu zdravstvenu zaštitu
5. Neformalna plaćanja doktorima
6. Dugotrajna nega za stariju populaciju
7. Dijalize urađene van klinike
8. Carski rez u odnosu na 1.000 životrođenih

U četvrtoj grupi, koja je procenjivala raspon i domet pruženih usluga u zdravstvenom sistemu, najviše bodova je dodeljeno Holandiji (24), zatim Španiji (18) i Sloveniji (18), Hrvatskoj (16), Makedoniji (15) i Italiji (14), a najmanje bodova su ostvarile Albanija i Bugarska (9). Raspon i domet pruženih usluga u Srbiji je ocenjen sa 11 bodova, što je neznatno više od Albanije i Bugarske (Tabela 5). Kroz pokazatelj broj pet (neformalna plaćanja doktorima) jasno je vidljiv problem s korupcijom u zemljama u regionu, odnosno mali broj transplantacija bubrega. Broj transplantacija bubrega je odlično ocenjen u Holandiji i Španiji, a od zemalja u okruženju samo u Hrvatskoj.

Za pohvalu u zdravstvenom sistemu Srbije je procenat dijaliza urađenih van klinika, koji je nešto bolji u poređenju sa drugim zemljama iz regionala. To pokazuje doslednost politike prebacivanja zadovoljenja potreba stanovništva na jeftinije i efikasnije metode lečenja.

V grupa – Izlazni efekti prevencije procenjeni su na osnovu sledećih pokazatelja:

1. Vakcinacija odojčadi
2. Visina krvnog pritiska
3. Prevencija pušenja
4. Prevencija alkohola
5. Fizička aktivnost
6. HPV vakcinacija
7. Smrtnost u saobraćaju

Kada je reč o izlaznim efektima preventivnih aktivnosti, najveći broj bodova je ostvarila Španija (18), a slede je Makedonija (16), Italija (16) i Slovenija (15). Najmanji broj bodova je zabeležen kod Hrvatske (10). Srbija je u zlatnoj sredini sa ostvarenih 13 bodova (Tabela 6). Pregledom pete grupe pokazatelja uočava se da je Makedonija na prevenciji postigla bolje rezultate čak i

od prvoplazirane Holandije. Prevencija pušenja nije dala očekivane rezultate ni u jednoj zemlji u okruženju, pa ni u Holandiji, što zahteva određene korekcije, kako bi se postigla bolja efikasnost traženih parametara.

U Srbiji ima prostora za poboljšanje izlaznih efekata preventivnih aktivnosti kroz povećanje procenta vakcinisane odojčadi, većeg angažovanja na prevenciji pušenja i konzumiranja alkohola, a naročito u realizaciji Nacionalnog programa za tinejdžerke. U odnosu na zemlje iz okruženja, Srbija se ističe dobrim rezultatima sprovedenih aktivnosti na fizičkoj aktivnosti i smanjenju visine krvnog pritiska kod stanovništva.

VI grupa – Korišćenje farmaceutika je procenjeno na osnovu sledećih pokazatelja:

1. Ukupna prodaja farmaceutskih proizvoda koji su plaćeni javnim subvencijama
2. Postojanje Lajman-adaptirane farmakopeje dostupne javnosti
3. Stopa primene novih lekova za rak
4. Dostupnost novih lekova
5. Korišćenje lekova za artritis
6. Korišćenje metmorfina
7. Korišćenje antibiotika po glavi stanovnika

Procena korišćenja i dostupnosti pojedinih lekova je ponovo stavila Holandiju na prvo mesto (18), a slede je Makedonija (15), Španija (14), Slovenija (14) i Hrvatska (13). Najmanje bodova su ostvarile Crna Gora (11) i Albanija (11), a neznatno više od njih Italija (12), Bugarska (12) i Srbija (12) (Tabela 7).

Srbija je u proceni farmaceutskih pokazatelja i korišćenja proizvoda plaćenih javnim subvencijama dobila slabu ocenu. Stopa primene specifičnih novih koncepata i novih lekova za lečenje raka morala bi u Srbiji biti bolja, kao i korišćenje leko-

va za terapiju artritisa, kako bi se približili zemljama Evropske Unije i zdravstveni sistem učinili efikasnijim.

ZAKLJUČAK I PREPORUKE

Zdravstveni sistem u Srbiji se, prema Evropskom zdravstvenom potrošačkom indeksu (EHCI) našao na 33. mestu sa 473 boda od maksimalnih 1.000 bodova. Na vrhu ove liste je već godinama Holandija, koja je ove godine ostvarila 898 bodova. Ovo rangiranje i primjenjeni parametri omogućavaju jasan uvid u to što je u zdravstvu Republike Srbije dobro, a što treba da se poboljša, kako bi se došlo do glavnog cilja, a to je zadovoljan i zdrav korisnik (potrošač) zdravstvenog sistema.

Pozitivni pomaci u Srbiji su učinjeni u poboljšanom pristupu lekarima primarne zdravstvene zaštite, poboljšanoj dostupnosti podacima o lekovima, povećanom procentu dijaliza u rađenih van klinike, kao i dobri rezultati sprovedenih aktivnosti na smanjenju visine krvnog pritiska kod stanovništva.

Da bi korisnik zdravstvene zaštite u Republici Srbiji bio zdraviji i zadovoljniji, trebalo bi poboljšati:

- uključenost pacijenata u zdravstvenu politiku i obavešteneost pacijenata,
- aktivnosti na prevenciji i promociji,
- aktivnosti na smanjenju nepovoljnih ishoda lečenja,
- aktivnosti na smanjenju nejednakog pristupa zdravstvenoj zaštiti,
- aktivnosti na smanjenju smrtnosti odojčadi,
- aktivnosti na smanjenju procenta obolelih od kancera,
- aktivnosti na sprečavanju korupcije u zdravstvu.

Procena efikasnosti zdravstvenog sistema u Srbiji iz ugla EHCI omogućava i definisanje preporuka za unapređenje srpskog zdravstva, kako bi ono funkcionalo u skladu s normama evropskih standarda, i zadovoljstva samih korisnika.

Da li ste pažljivo čitali radove?

1. Za eliminaciju dentalnog stresa neophodan je:
 - a) klasičan pristup lečenju
 - b) individualan pristup lečenju
 - c) multidisciplinarnost u lečenju
2. Najmanja ocena zdravstvenog sistema Republike Srbije za testiranih 48 pokazatelja bila je:
 - a) 1
 - b) 2
 - c) 3
3. Anksiolitički efekat muzike je proučavan kod bolesnika sa:
 - a) kardiološkim oboljenjima
 - b) oboljenjima bubrega
 - c) akutnim stanjima
4. Muzika dentalnu uznemirenost tretira:
 - a) direktnim efektom na terapijski postupak
 - b) direktnim efektom na pacijenta
 - c) efektom skretanja pažnje i opuštanja
5. Bakterija *Enterococcus faecalis* je u kavitetima sa dubokim karijesom bila zastupljena u:
 - a) 80% uzorka
 - b) 16% uzorka
 - c) 32% uzorka
6. Najčešća bakterija u kavitetima sa dubokim karijesom bila je:
 - a) *Enterococcus faecalis*
 - b) *Porphyromonas gingivalis*
 - c) *Escherichia coli*
7. Aktivna muzička terapija ima više efekata od pasivne?
 - a) Da
 - b) Ne
 - c) Ponekad
8. Nakon terapije dubokih karijesnih lezija *Enterococcus faecalis* je zabeležen u:
 - a) 40% uzoraka
 - b) 30% uzoraka
 - c) 18% uzoraka
9. Kliničko istraživanje dubokog karijesa je izvedeno kod:
 - a) 29 pacijenata
 - b) 49 pacijenata
 - c) 69 pacijenata
10. U terapiji dentalnog stresa se koristi muzika?
 - a) Da
 - b) Ne
 - c) Zavisi od težine stomatološke intervencije
11. Tokom kliničkog istraživanja dubokog karijesa:
 - a) uziman je jedan mikrobiološki bris
 - b) uzimana su dva mikrobiološka brisa
 - c) uzimana su tri mikrobiološka brisa
12. Najveća ocena zdravstvenog sistema Republike Srbije za određeni pokazatelj bila je:
 - a) 3
 - b) 4
 - c) 5
13. Muzikoterapija je:
 - a) invazivna anksiolitička metoda
 - b) neinvazivna anksiolitička metoda
 - c) bolna anksiolitička metoda
14. Kliničko istraživanje dubokog karijesa je proveravano kod:
 - a) 48 stalnih zuba
 - b) 45 stalnih zuba
 - c) 55 stalnih zuba

15. Zdravstveni sistem Republike Srbije u 2014. godini rangiran je sa:
- a) 473 boda
 - b) 898 bodova
 - c) 643 boda
16. Terapija muzikom može biti:
- a) aktivna
 - b) pasivna
 - c) i aktivna i pasivna
17. Mikrobiološka analiza sa zidova kavite zuba sa dubokim karijesom urađena je:
- a) klasičnom mikrobiološkom analizom
 - b) PCR tehnikom
 - c) i jednom i drugom tehnikom
18. Prema Evropskom zdravstvenom potrošačkom indeksu, zdravstveni sistem u Srbiji je zauzeo:
- a) 13. mesto
 - b) 33. mesto
 - c) 63. mesto
19. Muzika u ordinaciji:
- a) stvara pozitivnu atmosferu
 - b) olakšava bolne senzacije pacijentu
 - c) otežava rad terapeutu jer mu remeti koncentraciju
20. Uzorci mikrobiološkog materijala iz kavite sa dubokim karijesom posle terapije su uzimani posle:
- a) 30 dana
 - b) 40 dana
 - c) 60 dana

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