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## Antimikrobni učinak klorheksidina kod ortodontskih pacijenata

### *Antimicrobial Effects of Chlorhexidine in Orthodontic Patients*

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#### Sažetak

**Svrha:** Svrha ove pokusne studije jest utvrditi djeluje li 1-postotni klorheksidinski i 1- postotni timolni lak (Cervitec®) na razinu mutans-streptokoka (SM-a) i laktobacila (LB-a) kod pacijenata s fiksnim ortodontskim napravama. **Materijal i metode:** U istraživanju je sudjelovalo dvanaest ljudi. Sudionici su imali intenzivni tretman - klorheksidinski lak nanošen im je tri puta tijekom tjedan dana. Uzorci sline iz kojih se utvrđivala količina bakterija, uzeti su prije prve aplikacije klorheksidina te mjesec i dva mjeseca nakon nje. **Rezultati:** Mjesec dana nakon terapije razina SM-a i LB-a smanjila se kod šest pacijenata s visokom razinom tih bakterija prije početka liječenja. Kod onih s niskom razinom SM-a i LB-a (šest ispitanika) prije nanošenja preparata, nije bilo znatnih promjena. Dva mjeseca nakon terapije razina bakterija počela je ponovno rasti. **Zaključak:** To upućuje na to da preparat djeluje neko vrijeme, a zatim je potrebno ponoviti terapiju.

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#### Ključne riječi

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#### Uvod

Fiksne ortodontske naprave mogu se smatrati napravama koje otežavaju održavanje oralne higijene i omogućuju akumulaciju plaka (1). Osim toga, metalne se bravice smatraju odgovornima za snižavanje pH-a te demineralizaciju tvrdih zubnih tkiva oko njihovih baza (2). U usnoj su šupljini također uočene povišene razine kariogenih bakterija *Streptococcus mutans* i *Lactobacillus spp.* ubrzo nakon postavljanja ortodontskih naprava (3, 4).

#### Introduction

It is considered that fixed orthodontic appliances contribute to plaque accumulation and that they are challenging in implementing proper oral hygiene (1). Metal brackets are meant to be responsible for lowering of the pH level and the demineralization of tooth hard tissue around their bases (2). Also, it has been recognized that the number of *mutans streptococci* (SM) and *lactobacilli* (LB) increase in the oral cavity after orthodontic bonding (3, 4).

Kako bi se izbjegle te neželjene pojave, odlučeno je da se primijene klorheksidin, bakteriostat-ski, odnosno baktericidni bis-bigvanid u obliku laka koji omogućuje ciljanu aplikaciju na rizična mjesta – oko bravica, u fisure ili interdentalne prostore bez znatnijeg utjecaja na sluznicu (5, 6). Dosadašnja istraživanja utjecaja klorheksidina na ortodon-ske pacijente temeljila su se uglavnom na proučava-nje razine mutans-streptokoka u plaku oko bravica i redukcije karijesa (7, 8, 9), no malo se stručnjaka bavilo njegovim utjecajem na laktobacile (10, 11). Kao što je poznato, mutans-streptokoki smatraju se odgovornima za inicijaciju karijesne lezije, a lakto-bacili za njezinu progresiju. Osnovni zadatak istra-živanja bio je procijeniti učinkovitost 1-postotnog klorheksidinskog i 1-postotnog timolnog antimikrobnog laka Cervitec® (*Ivoclar Vivadent, Schaan, Lichtenstein*) na razine *Streptococcus mutans* (SM-a) i *Lactobacillus spp.* (LB-a) u slini pacijenata s fiksnom ortodontskom napravom. Drugi je zada-tak bio ustanoviti svrhovitost primjene Cerviteca®, ovisno o stupnju karijesne rizičnosti pacijenta.

## Materijali i postupci

U ovoj pokusnoj studiji obavljeno je longitu-dinalno kliničko istraživanje utjecaja 1-postotnog klorheksidinskog laka na razinu SM-a i LB-a kod pacijenata s fiksnim ortodontskim napravama.

Sudionici u istraživanju bili su pacijenti Zavo-da za ortodonciju Klinike za stomatologiju KBC-a Zagreb. Svakom od njih bio je objašnjen postupak te moguće popratne pojave. U istraživanje su bili uključeni nakon što su njihovi roditelji ili skrbni-ci potpisali informirani pristanak. Odabrano je dva-naest ispitanika s prosječnom duljinom nošenja fik-sne ortodontske naprave na barem jednom zubnom luku od 13,6 mjeseci, a prosječna dob sudionika bi-la je 15,5 godina (11-19). Isključeni su bili pacijen-ti koji su u posljednja dva mjeseca primali antibiot-sku terapiju.

Svakom sudioniku određen je DMFT-indeks te uzeti uzorci sline, kako bi se individualno procijeni-la karijesna rizičnost. Slina se stimulirala jednomi-nutnim žvakanjem parafinske tablete te se pet minuta skupljala u sterilnu epruvetu. CRT® bacteria (*Ivoclar Vivadent, Schaan, Lichtenstein*) koristila se kao sred-stvo kojim je detektirana količina bakterija u slini prije nanošenja klorheksidinskog laka, te jedan i dva mjeseca nakon toga. Njegova je karakteristika da se u jednom nalaze mikrobiološke podloge za rast mutans

With the intention to resolve these issues, the idea of a chlorhexidine varnish was introduced. The improvement is demonstrated in its precise applica-tion to caries risk sites – around brackets, fissures and adjacent sites eliminating the adverse effect to oral mucosa (5, 6).

Numerous researches were conducted to inves-tigate the effect of chlorhexidine, bacteriostatic or bactericid bis-biguanide in orthodontic patients and they were mostly based on evaluating the levels of SM in plaque around brackets and caries reduction (7, 8, 9). A small number of them investigated the effect on LB (10, 11). Previous research in caries pathology showed that the MS are responsible for initiation of caries lesions, and the LB for its pro-gression. The main purpose of the study is to eval-uate the efficiency of 1% chlorhexidine-1% thymol antibacterial varnish, Cervitec® (*Ivoclar Vivadent, Schaan, Lichtenstein*), on *Streptococcus mutans* and *Lactobacillus spp.* saliva levels in patients with fixed orthodontic appliances. Based on this data we can identify the individuals at high caries risk and see the effect of Cervitec® treatment on patients with fixed orthodontic appliances.

## Material and Methods

A longitudinal clinical pilot study was performed with the intent of ratification the 1% chlorhexidine varnish effect on SM and LB saliva levels in pa-tients with fixed orthodontic appliances. Patients treated with fixed orthodontic appliances in Depart-ment of Orthodontics, Dental Clinic, KBC Zagreb, were invited to participate. They were informed in verbal and written form about the procedure and the potential side effects. Participants were enclosed in the study after signing the consent form by their par-ents. Twelve participants were included with medi-an therapy duration of 13,5 months and median age of 15,5 years (11-19). Patients who were under an-tibiotic treatment during the last 2 months were ex-cluded.

Saliva samples were taken and DMFT index was determined to identify the caries risk of each patient. Paraffin-stimulated saliva samples during 5 minutes were collected. CRT® bacteria (*Ivoclar Vivadent, Schaan, Lichtenstein*) was used to determine the sa-liva SM and LB counts before the chlorhexidine var-nish application and then 1 and 2 months after the varnish administration. CRT® bacteria contains 2 mi-crobial growth surfaces – one for *Streptococcus mu-tans* and the other for *Lactobacillus spp.* so they are simultaneously detected. Previously obtained saliva

streptokoka i laktobacila, tako da se istodobno očitavaju. Prije toga je dobivena slina prenesena sterilnom pipetom na mikrobiološke podloge, tako da je cijela njihova površina bila prekrivena slinom. U posudu u kojoj su bile podloge stavljena je tableta natrijev-hidrogenova karbonata iz koje se otpušta ugljični dioksid. Tako su stvoreni uvjeti pogodni za rast bakterija. Uzorci su označeni imenom i datumom te ostavljeni 48 sati u Cultura inkubatoru (*Ivoclar Vivadent, Schaan, Lichtenstein*) na 37°C.

Pismeno i usmeno ispitanici s fiksnom ortodontskom napravom obaviješteni su kako trebaju održavati oralnu higijenu.

Kod sudionika je primijenjen takozvani "intenzivni oblik tretmana", a sastojao se od triju aplikacija Cerviteca® tijekom tjedan dana.

Procedura je obavljena u skladu s uputama proizvođača. Prva aplikacija klorheksidinskog laka bila je nanosena već tijekom prvog posjeta nakon što im je uzet uzorak sline za procjenu početne razine SM-a i LB-a. Postupak je proveden tako da su svi zubi najprije temeljito očišćeni rotirajućom četkicom i pastom Proxit® (RDA 83) (*Ivoclar Vivadent, Schaan, Lichtenstein*) koja sadržava ksilitol i aminfluorid. Pasta je zatim isprana, zubi osušeni i izolacija radnog polja osigurana svicima staničevine. Cervitec® je nanosen malim kistom u tankom sloju oko bravica te se 30 sekundi sušio.

Uzorci sline uzeti su nakon jedan i dva mjeseca poslije prve aplikacije na isti način kao i tijekom prvog posjeta, kako bi se kvantitativno odredile razine mutans streptokoka i laktobacila. Očitani su nakon što su dva dana bili u inkubatoru na 37°C, usporedbom s dijagramom dobivenim od proizvođača.

Broj mutans streptokoka i laktobacila izražen je u logaritamskom mjerilu. Postavljena je nulta hipoteza - aplikacija Cerviteca oko bravica ortodontskih pacijenata nema utjecaja na razine SM-a i LB-a u njihovim uzorcima sline. Za statističku obradu koristio se programski paket SPSS 13.0 (SPSS, Inc, Chicago, Illinois) za Windows, a nulta hipoteza ispitana je  $\chi^2$  testom. Rezultati su prikazani u obliku deskriptivne statistike te analizirani Kruskal-Walisonim i Mann-Whitneyim testom.

## Rezultati

Očitavanja razina mutans streptokoka i laktobacila prikazana su na Slici 1. Usporedbom srednjih vrijednosti iz prvog mjerenja (prije aplikacije Cer-

was transferred on the growth surfaces with a sterile pipette, the whole surface being wetted and covered with saliva. In the cartridge in which the growth surfaces were maintained a sodium peroxide carbonate tablet (provided by the manufacturer of CRT® bacteria) was put. The tablet releases carbon dioxide and ensures conditions needed for bacterial growth. After the samples were signed with date and patient's name, they were incubated at 37°C for 48 hours in the Cultura incubator (*Ivoclar Vivadent, Schaan, Lichtenstein*). The participants were instructed in written and verbal form in proper oral hygiene maintenance for fixed orthodontic appliances.

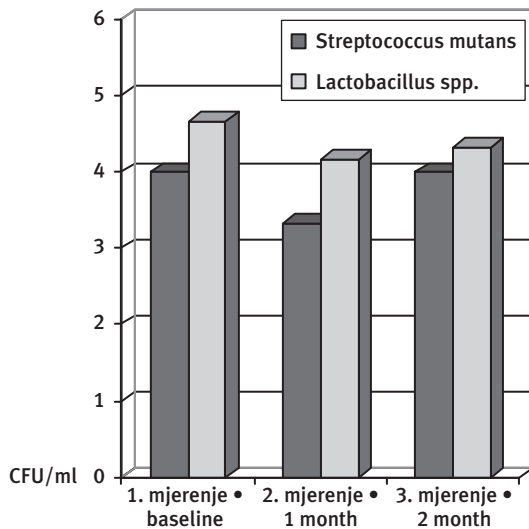
Patients went through an intensive mode treatment consisting of three applications of Cervitec® during 1 week.

The procedure was performed according to the manufacturer's instructions. The first application of the chlorhexidine varnish was conducted during the first visit immediately after taking the saliva samples for baseline SM and LB levels determination. Before application of Cervitec®, plaque was removed with a rotating toothbrush and Proxit® paste (RDA 83) (*Ivoclar Vivadent, Schaan, Lichtenstein*) which contains xylitol and aminofluoride. The paste was then rinsed out, the teeth were dried with compressed air and a dry working field was accomplished using cotton rolls. Cervitec® was applied with a small brush in a thin layer around each bracket and allowed to set for 30 seconds. Follow-up saliva samples were collected 1 and 2 months after the first administration of varnish for SM and LB levels determination in the same manner as it has been described previously. The SM and LB counts were determined after 2 days incubation according to the manufacturer's diagram.

The bacteriological counts were logarithmically transformed before statistical analysis. The null-hypothesis was set: there is no influence of Cervitec® application around the brackets of orthodontic patients on lowering the levels of MS and LB in their saliva samples. For statistical analysis of collected data program package SPSS 13.0 (SPSS, Inc, Chicago, Illinois) for Windows was used. For testing of the hypothesis  $\chi^2$  test was used. The continuous variables were tested with Mann-Whitney and Kruskal-Wallis tests.

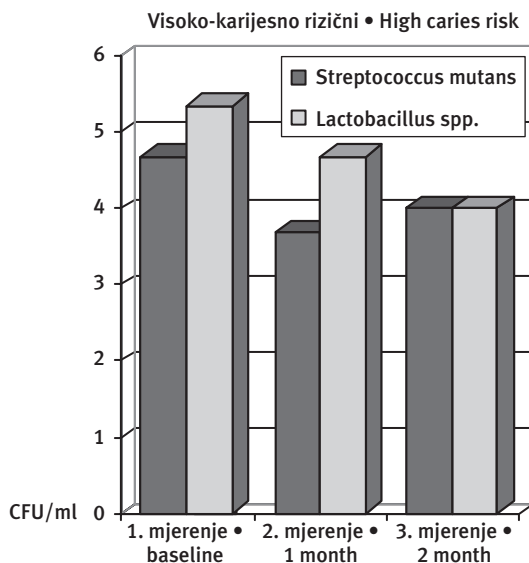
## Results

The effect of Cervitec® application on *Streptococcus mutans* and *Lactobacillus spp.* saliva levels are presented in Figure 1. The mean level of MS



**Slika 1.** Srednje vrijednosti razina SM-a i LB-a tijekom prvog posjeta te prvog i drugog mjeseca nakon prve aplikacije Cerviteca® kod svih ispitanika ( $10^n$  CFU/ml sline).

**Figure 1** *Streptococcus mutans* and *Lactobacillus spp.* mean levels at baseline and 1 and 2 months after Cervitec® application in the whole group ( $10^n$  CFU/ml saliva).



**Slika 2.** Srednje vrijednosti razina SM-a i LB-a tijekom prvog posjeta te prvog i drugog mjeseca nakon prve aplikacije Cerviteca® u visoko karijesno rizičnoj skupini ( $10^n$  CFU/ml sline).

**Figure 2** *Streptococcus mutans* and *Lactobacillus spp.* mean levels in high caries risk group at baseline and 1 and 2 months after Cervitec® application ( $10^n$  CFU/ml saliva).

viteca®) sa srednjim vrijednostima drugog mjerenja (mjesec dana nakon aplikacije) uočava se pad u broju kariogenih bakterija. U trećem mjerenju (dva mjeseca nakon aplikacije) zapažen je postupno po-

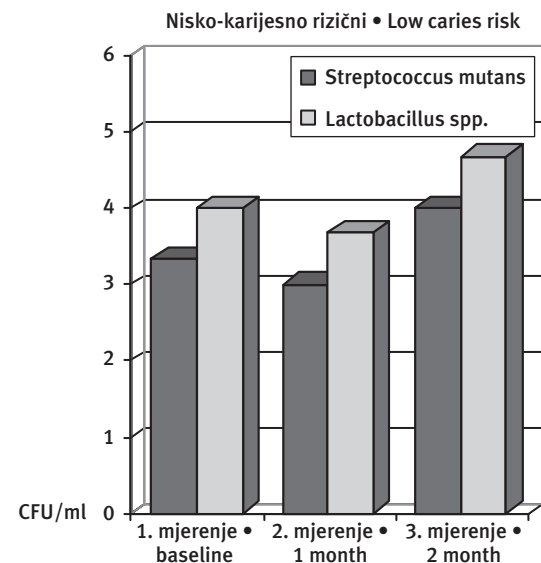
**Tablica 1.** Rezultati početnog očitavanja SM-a i LB-a te prvog i drugog mjeseca nakon prve aplikacije Cerviteca®, analizirani Kruskal-Wallisovim testom.

**Table 1** Results of baseline LB and SM level and of levels 1 and 2 months after first Cervitec® application analyzed with Kruskal-Wallis test

	Očitavanje • Reading	N	Prosječni rang • Mean Rank
LB	prvi posjet • baseline	12	10,92
	1 mjesec • 1 month	12	8,33
	2 mjeseca • 2 months	12	9,25
	Ukupno • Total	36	
SM	prvi posjet • baseline	12	10,33
	1 mjesec • 1 month	12	6,67
	2 mjeseca • 2 months	12	11,50
	Ukupno • Total	36	

( $X^2$ (LB) = .802; df =2; p = .670)

( $X^2$ (SM) =3,273; df =2; p = .195)



**Slika 3.** Srednje vrijednosti razina SM-a i LB-a tijekom prvog posjeta, te prvog i drugog mjeseca nakon prve aplikacije Cerviteca® u nisko karijes rizičnoj skupini ( $10^n$  CFU/ml sline).

**Figure 3** *Streptococcus mutans* and *Lactobacillus spp.* mean levels in low caries risk group at baseline and 1 and 2 months after Cervitec® application ( $10^n$  CFU/ml saliva).

and LB was reduced 1 month after application when compared with baseline. Two months after application a slight increase of MS and LB mean level was recognized but it did not reach the baseline value.

rast broja kariogenih bakterija, no vrijednosti još nisu dosegnule razine iz prvog mjerenja. Isti se nalazi zapažaju u Tablici 1. koja sadržava rezultate obrađene Kruskal-Wallisovim testom.

Prema razini mutans streptokoka i laktobacila prije aplikacije laka, pacijenti su podijeljeni u dvije skupine - onu s visokom razinom mutans streptokoka i laktobacila te u onu s niskom razinom kao indikatorom karijesnih rizičnosti. Broj mutans streptokoka i laktobacila u slini mjesec dana nakon terapije pokazao je pad u skupini s visokim početnim vrijednostima kariogenih bakterija. Dva mjeseca od početka terapije utvrđen je polagani rast broja mutans streptokoka i laktobacila u odnosu prema prijašnjim vrijednostima, ali razine još nisu dosegnule one prije početka terapije (Slika 2.).

U skupini s niskim početnim vrijednostima kariogenih bakterija, mjesec dana nakon terapije također je uočen pad broja mutans streptokoka i laktobacila, ali ne tako izražen kao u prvoj skupini. Dva mjeseca nakon terapije u toj se skupini dogodio porast kariogenih bakterija iznad početnih vrijednosti iz prvog mjerenja, što se vidi na Slici 3.

## Rasprava

Rezultati prijašnjih istraživanja utjecaja Cerviteca® na kariogene bakterije u slini razlikuju se. Eronat i Alpöz izvijestili su o znatnom padu mutans streptokoka nakon primjene 1-postotnog klorheksidinskog laka, što je u skladu s rezultatima dobivenima u našem istraživanju (11). Ali, Ogaard i njegovi suradnici istaknuli su da uz velik pad broja mutans streptokoka u plaku nakon aplikacije antimikrobnog laka nije uočena nikakva promjena razine tih bakterija u slini (8). To objašnjavamo frekvencijom aplikacije Cerviteca®. Ti su znanstvenici u svojem istraživanju pet puta nanosili Cervitec tijekom 21 tjedna - jedanput na tjedan tijekom 3 tjedna do postavljanja fiksnog ortodontskog aparata te 6. i 18. tjedan nakon toga. U našem istraživanju koristila se intenzivna metoda aplikacije Cerviteca® - tri puta tijekom jednog tjedna. Naime, od ranije je iz literature poznato da su intenzivne metode dale znatno bolje rezultate od aplikacije s većim intervalima nanošenja (7, 8, 12). Eronat i Alpöz izvijestili su da već nakon prve aplikacije Cerviteca® u slini reduciraju kariogene bakterije (11). Twetman i suradnici uspoređivali su intenzivnu terapiju (tri puta od 7 do 10 dana) s mjesečnom metodom aplikacije (3 puta tijekom tri mjeseca) i zaključili da kod obiju pada broj kariogenih bakterija, ali da je učinak veći i dugotrajniji kod intenzivnog načina (13). Točnije, uočili su statistič-

Same results are summarized in Table 1 after Kruskal-Wallis test analysis.

According to baseline levels of *Streptococcus mutans* and *Lactobacillus spp.* patients were divided into a group with high SM and LB level and the group with low SM and LB level indicating the caries risk of participants. The recording of SM and LB saliva counts in the group with high baseline level 1 month after application showed a reduction when compared with the baseline level. Two months after the first application of varnish a slight increase of SM and LB counts was noticed, but the level did not reach the baseline level (Figure 2).

In the group with low baseline levels of cariogenic bacteria 1 month after first application a reduction of SM and LB counts was also recorded, but in a smaller amount when compared with the first group. After 2 months this group showed an increase of SM and LB level above the baseline level that is summarized in Figure 3.

## Discussion

The results of previous studies assessing the effect of Cervitec® on cariogenic bacteria differ. Eronat and Alpöz reported on significant reduction of SM saliva levels after 1% chlorhexidine application what is supported with results of our study (12). In contrast, Ogaard et al. announced a significant decrease of SM counts in plaque after this antimicrobial varnish application and no reduction in saliva SM counts (8). This is probably a result of different frequency of Cervitec® application. In their research, Ogaard et al. have administrated Cervitec® 5 times during a 21 week period. Precisely, once a week during the three week period before bonding of the appliance and then in the sixth and eighteenth week of fixed orthodontic therapy. In our study, the intensive mode of application was used: three times during 1 week. Namely, it is known from previous literature that the intensive modes obtained more efficient results when compared with longer period application regimens (7, 8, 12). Eronat and Alpöz have signified that even 1 application of Cervitec® causes a reduction in SM saliva levels (11). Twetman et al. have compared the intensive mode (3 applications within 7-10 days) with the monthly mode (3 times during 3 months). They have found that both regimens cause a decrease of cariogenic bacteria, but differ in the intensity and duration of the effect in favor of the intensive mode (13).

ki veliku redukciju SM-a u slini mjesec dana nakon aplikacije u skupini tretiranoj intenzivno, a u skupini s mjesečnom aplikacijom nije bilo statistički veće razlike.

Prije aplikacije Cerviteca® svakom je pacijentu uzet DMFT indeks te uzorak sline radi određivanja početne razine mutans streptokoka i laktobacila, a zbog procjene karijesne rizičnosti pacijenta. Prema tim parametrima ispitanici su podijeljeni u dvije skupine - onu s visokim DMFT-om i onu s niskim. Ti su podaci prikazani te statistički analizirani Mann-Whitneyim testom, što se može vidjeti u Tablici 2. Nije pronađena korelacija DMFT-a s razinom mutans streptokoka i laktobacila u prvom mjerenju. To se može objasniti postavljanjem fiksne ortodontske naprave, jer ona uzrokuje izrazite promjene uvjeta u usnoj šupljini - nakon toga raste karijesna rizičnost,

More accurate, they noticed a statistically significant reduction of SM saliva levels 1 month after application in the intensive mode group, while no significant decrease in the monthly mode was found.

Prior to the application of Cervitec®, DMFT index was determined and saliva samples were taken for affirming the baseline SM and LB counts with the intent of identifying the caries risk of each patient. According to DMFT parameter patients were divided in 2 groups: group with high DMFT scores and the one with low DMFT scores. The results are summarized and analyzed using Mann-Whitney test (Table 2). There has been no correlation between DMFT index and SM and LB baseline levels. This could be the consequence of the recently bonded fixed orthodontic appliance. The appliance causes many changes in intraoral environment in terms of caries risk which is seen as a direct

**Tablica 2.** Analiza korelacije DMFT-a i razina SM-a i LB-a tijekom prvog posjeta Mann-Whitneyim testom  
**Table 2** Analysis of correlation of DMFT and LB and SM baseline level with Mann-Whitney test

	DMFT	N	Prosječni rang • Mean Rank	Suma rangova • Sum of Ranks
L.B.	,00	12	3,50	7,00
	1,00	12	2,67	8,00
	Total	24		
S.M.	,00	12	2,75	5,50
	1,00	12	3,17	9,50
	Total	24		

(Z(LB) = -,645; p = ,519)  
(Z(SM) = -,333; p = ,739)

što je izravno vidljivo iz broja mutans streptokoka i laktobacila. Za razliku od toga DMFT indeks upućuje na karijesnu rizičnost prije postavljanja naprave, te je ona bila determinirana drugim čimbenicima. Lundstöm i suradnici uočili su porast mutans streptokoka i laktobacila nakon postavljanja fiksne ortodontske naprave (3). O porastu mutans streptokoka nakon što se postavi fiksna ortodontska naprava izvijestili su također Ogaard i njegovi suradnici (8). Sandham i suradnici nekoliko su puta proučavali DMFT indeks, no tražili su povezanost toga indeksa s dobivenim rezultatima kao odgovorom na terapiju antimikrobnim lakom. U istraživanju na odraslima dobili su sljedeće rezultate: kod pacijenata s visokom incidencijom DMFT-a odgovor na antimikrobni lak bio je slab u usporedbi sa skupinom koja je imala dva puta manji DMFT indeks. To je objašnjeno mnogobrojnim ispunnima u čije se rubne pukotine mogu zauvući bakterije koje tada postaju nedostupne djelovanju antimikrobnog laka te su izvor rekolonizacije (14). U ovom slučaju radi se o pacijentima koji nisu bili u fiksno-

repercussion in SM and LB levels. On the opposite, the DMFT index indicates a caries risk that preceded the bonding of the appliance and was determined by the influence of other factors. Lundstöm et al. have noticed an increase of *Streptococcus mutans* and *Lactobacillus spp.* counts after bonding the fixed orthodontic appliance (3). Level of the SM increase after beginning of fixed orthodontic therapy was also reported by Ogaard et al (8). Sandham et al. have investigated DMFT index several times, but they were interested in its correlation with the results of SM level after antimicrobial varnish therapy. The participants of the study were adults and the results were: in patients with high DMFT scores there was a slight reduction as an answer to the chlorhexidine administration shown in comparison to the group who had low DMFT scores. This was explained to be the consequence of a high number of fillings. The restorations provide retentive sites around their margins where bacteria are sheltered from the effects of chlorhexidine. They are the source of rapid recolonization (14). In the mentioned research

ortodontskoj terapiji te ne možemo govoriti o modifikaciji karijesne rizičnosti. U istraživanju u kojem je odabrana skupina ispitanika bila sastavljena od djece, u fiksno-ortodontskoj terapiji nije pronađena povezanost (15). Taj je nalaz objašnjen općenito malim DMFT-om koji je u skladu s dobi ispitanika te na tom uzorku nisu niti mogli proučavati ovisnost toga parametra i rezultata.

U skupini s visokim početnim vrijednostima kariogenih bakterija, broj SM-a i LB-a u slini počeo je padati mjesec dana nakon terapije. Dva mjeseca kasnije utvrđen je porast u odnosu prema prijašnjim vrijednostima, ali razine još nisu doseglye one prije početka terapije (Slika 2.). Taj porast upućuje na slabljenje djelovanja Cerviteca® i vremenski interval u kojem je potrebno ponoviti terapiju. Na taj način određen je protokol primjene sredstva na četiri puta na godinu. Mnogobrojna istraživanja redukcije kariogenih bakterija 1-postotnim klorheksidinskim lakom razlikuju se u intervalu aplikacije dobivenom u istraživanju. Twetman i suradnici odredili su dvomjesečni interval aplikacije Cerviteca® (7), a Eronat i Alpöz izvijestili su da je potreban tromjesečni interval, što je u skladu s našim protokolom primjene Cerviteca® (11). U niskorizičnoj skupini mjesec dana nakon terapije bio je uočen pad broja SM-a i LB-a, ali ne tako izražen kao u visokorizičnoj skupini. Dva mjeseca nakon terapije porastao je broj kariogenih bakterija iznad početnih vrijednosti iz prvog mjerenja (Slika 3.). Uzrok je vjerojatno prevalencija ispitanika koji su na početku u istraživanju nosili fiksne ortodontske naprave tek dva do četiri mjeseca. Sheie i suradnici pokazali su da tri mjeseca nakon postavljanja fiksne ortodontske naprave broj kariogenih bakterija raste u odnosu prema razini prije ortodontske terapije (16).

## Zaključak

Cervitec® je pokazao redukcijski učinak na broj mutans streptokoka i laktobacila kod pacijenata s utvrđenim visokim razinama. Preporučuje se odabir pacijenata za terapiju Cervitecom nakon što im se odredi individualni rizik za karijes na temelju broja mutans streptokoka i laktobacila. Kod pacijenata s visokim razinama tih bakterija opravdana je uporaba 1-postotnog klorheksidinskog laka u tromjesečnim intervalima.

## Zahvala

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the participants were adults and were not in fixed orthodontic therapy so we can not speak of caries risk modification after bonding the appliance. In another research of the same author where the participants were children in fixed orthodontic therapy no correlation was found (15). The author explained this as a result of low DMFT scores that correspond to the age of participants so this patient's sample was not representative to investigate the correlation between DMFT index and gained results.

The recording of SM and LB saliva counts in the group with high baseline level 1 month after application showed a reduction when compared with the baseline level. Two months after the first application of varnish a slight increase of SM and LB counts was noticed, but the level did not reach the baseline (Figure 2). This growth of SM and LB counts indicates the subsiding Cervitec® effect and the time period in which the application should be repeated. In this way the administration protocol has been determined on 4 times a year. Many researches of cariogenic bacteria reduction with 1% chlorhexidine varnish differ in the application protocol determined with the study. Twetman et al. affirmed a bimonthly protocol of Cervitec® application (7). Eronat and Alpöz informed of an application protocol every three months which supports our results (11). In the low caries risk group, baseline levels of cariogenic bacteria showed a reduction 1 month after the first application, but in a smaller amount when compared with the first group. After 2 months this group showed an increase of SM and LB level above the baseline level (Figure 3). This is probably the consequence of prevalence in patients who, with the beginning of the study, were only 2-4 months in orthodontic treatment. Sheie et al. reported of cariogenic bacteria increase 3 months after bonding a fixed orthodontic appliance (16).

## Conclusion

Cervitec® caused a reduction of *Streptococcus mutans* and *Lactobacillus spp.* saliva counts in patients with previously identified high level of these bacteria. We recommend identifying patients permissible for Cervitec® therapy through a caries risk test determining the baseline level of SM and LB. In patients with high baseline SM and LB level therapy with 1% chlorhexidine varnish every three months is justifiable.

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**Abstract**

**Objective:** The purpose of this pilot study was to evaluate the effect of 1% chlorhexidine-1% thymol varnish (Cervitec®) on *Streptococcus mutans* (SM) and *Lactobacillus* spp. (LB) levels in patients with fixed orthodontic appliances. **Material and methods:** Twelve participants went through an intensive mode of application: chlorhexidine varnish was administered 3 times within a 1 week period. Saliva samples for determination of SM and LB baseline levels were collected before the first varnish administration followed by sampling 1 and 2 months after the first varnish application. **Results:** A month after administration the group with high colonization levels (6 persons) exhibited reduction of SM and LB counts when compared with baseline levels. The group with low colonization levels (6 persons) exhibited no significant reduction. Two months after treatment a slight growth of SM and LB counts was recognized. **Conclusion:** That indicates a time period of chlorhexidine efficiency and a necessary schedule of varnish application.

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**Key words**

Chlorhexidine; *Streptococcus mutans*;  
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