

Mogućnosti prevencije gingivitisa u toku terapije fiksnim ortodontskim aparatima

DOI: 10.2298/SGS0802123M

Possibilities to prevent gingivitis during fixed orthodontic appliance therapy

Sava Matic¹, Mirjana Ivanović¹, Jelena Mandić¹, Predrag Nikolić²¹ Klinika za dečju i preventivnu stomatologiju, Stomatološki fakultet, Beograd² Klinika za ortopediju vilica, Stomatološki fakultet, Beograd¹ Clinic for pediatric dentistry, School of dentistry Belgrade² Clinic for orthodontic, School of dentistry Belgrade

INFORMATIVNI RAD (IR) INFORMATIVE ARTICLE

KRATAK SADRŽAJ

Uvod: Pacijenti u toku terapije fiksnim ortodontskim aparatima su pod povećanim rizikom za nastanak oboljenja gingive, parodontcijuma i za nastanak karijesa. Da bi se tokom terapije fiksnim ortodontskim aparatima očuvalo zdravlje gingive pacijente treba informisati o važnosti svakodnevnog održavanja oralne higijene i obučiti pacijente kako da koriste sva dostupna sredstva za održavanje oralne higijene.

Cilj rada: Cilj rada je da prikaže faktore koji utiču na nastanak gingivitisa tokom tretmana fiksnim ortodontskim aparatima, kao i metode i sredstva koje se koriste za sprečavanje nastanka ovog rasprostranjenog oboljenja.

Zaključak: Uspostavljanje navike pravilnog održavanja oralne higijene je velike koristi ne samo za očuvanje zdravlja gingive već i za uspešnost celokupnog ortodontskog tretmana i očuvanje postignutih rezultata terapije. Osim očuvanja zdravlja gingive, navika održavanja oralne higijene ostaje za ceo život.

Ključne reči: gingivitis, fiksni ortodontski aparati, oralna higijena

SUMMARY

Introduction: During orthodontic treatment, the risk of gingivitis, periodontal disease and dental caries is increased. For good gingival health during orthodontic therapy, patients must be educated about the importance of daily oral hygiene and also given instructions on plaque-control techniques and how to use plaque removal devices properly.

Objectives: The aim of this study was to present risk factors for gingivitis during treatment with fixed orthodontic appliances as well as methods and resources for prevention of this widespread disease.

Conclusion: Maintaining proper oral hygiene is of great benefit not only for gingival health but also for the success of orthodontic treatment and maintenance of treatment results. Beside healthy gingiva, favourable habits in oral hygiene remain life-long.

Key words: gingivitis, fixed orthodontic appliances, oral hygiene

Uvod

Ortodontski tretman je široko priznat i prihvaćen u svakodnevnoj stomatološkoj praksi zbog svojih pozitivnih rezultata na dentofacijalni kompleks. Primenom fiksnih ortodontskih aparata kliničari mogu ponuditi pacijentima uspostavljanje funkcionalne okluzije, poboljšanje oralnog zdravlja i estetsko poboljšanje dentofacijalnog kompleksa. U zavisnosti od tipa i težine, malokluzije su često udružene sa neadekvatnom oralnom higijenom, oboljenjima parodontalnih tkiva, pojavom karijesa, oboljenjima temporo-mandibularnog zgloba, problemima pri govoru i disanjem na usta. Tretman fiksnim ortodontskim aparatima nudi odlične i predvidive rezultate, ali zahteva pacijentovu saglasnost i saradnju tokom planirane terapije¹.

Uticao malokluzija na oralno zdravlje

Poremećaj razvoja lica i vilica kao i sam ortodontski tretman mogu imati uticaja na oralno zdravlje. Pacijenti moraju biti informisani o važnosti očuvanja oralnog zdravlja, bez obzira da li će prihvatiti ili odbiti preporučeni ortodontski tretman sa obzirom da malokluzije mogu značajno uticati na oralno zdravlje. Odbijanjem, pacijenti se izlažu većem riziku za nastanak oralnih oboljenja. Prihvatanje ortodontskog tretmana podrazumeva pacijentovo poštovanje režima povećane pažnje usmerene na oralnu higijenu i oralno zdravlje, što sprečava potencijalne jatrogene probleme koji mogu nastati tokom tretmana.

Trajanje ortodontskog tretmana

Dužina trajanja tretmana zavisi od karakteristika svakog pojedinačnog slučaja. Na dužinu trajanja mogu uticati i pacijentove navike, pridržavanje uputstava o oralnoj higijeni i načinu ishrane kao i redovne kontrole. Prihvatanjem ortodontskog tretmana, pacijenti se obavezuju na jednu do tri godine aktivne terapije². Studije pokazuju da je prosek trajanja ortodontske terapije 23.5 meseci, sa opsegom od jednog do 37 meseci. Utvrđena je direktna, statistički signifikantna korelacija između loše oralne higijene i dužine trajanja tretmana. Po završetku ortodontskog tretmana fiksnim ortodontskim aparatima pacijenti moraju koristiti retencione aparate da bi se sprečila pojava recidiva.

Introduction

Orthodontic treatment is widely accepted in everyday dental practice due to its positive effects on the orofacial complex. Clinicians can offer patients functional occlusion, improved oral health and aesthetic improvements on the dentofacial complex by using fixed orthodontic appliances. Depending on the type and severity, malocclusions are often associated with inadequate oral hygiene, periodontal disease, caries, temporo-mandibular disorders, speech deficiencies and oral breathing. Treatment using fixed orthodontic appliances has excellent and predictable results but demands patient's consent and cooperation.¹

The effect of malocclusions on oral health

Anomalies during the development of face and jaws as well as orthodontic treatment itself may have an impact on oral health. Patients must be informed about the importance of oral health, irrespective of their choice of orthodontic treatment because malocclusions may have a significant effect on oral health. If they reject, they are exposed to greater risk for oral diseases. The acceptance of orthodontic therapy implies patient's respect towards greater awareness of oral hygiene and oral health which prevents potential iatrogenic problems that may arise during the treatment.

The duration of orthodontic treatment

The duration of orthodontic treatment depends on the characteristics of each individual case. It may be influenced by patient's habits, following the instructions on oral hygiene and dietary style as well as regular check-ups. By accepting orthodontic treatment, patients are committed to one to three years of active therapy.² Studies have shown that mean duration of orthodontic therapy is 23.5 months, with the range between one and 37 months. Direct and significant correlation has been established between poor oral hygiene and the duration of orthodontic treatment. After the treatment using fixed appliances, patients must use retention devices to prevent recurrence.

Uticaj fiksnih orodontskih aparata na zdravlje gingive

Obzirom na činjenicu da se ortodontska terapija najčešće sprovodi u periodu adolescencije još uvek je nejasno kako ortodontski tretman utiče na periodontalno zdravlje u dužem vremenskom periodu. Kliničari imaju podeljena mišljenja o povezanosti ortodontskog tretmana i periodontalnog statusa. Pojedini autori tvrde da nema trajnog oštećenja periodoncijuma kao posledice ortodontskog tretmana^{3,4}, dok drugi veruju da ortodontski tretman može izazvati prvi stadijum marginalnog periodontitisa^{5,6}. Povezanost između ortodontske terapije i pojave oboljenja parodonticijuma može postojati ako ortodontski prstenovi utiču na subgingivalno nakupljanje plaka i otežavaju njegovo uklanjanje, što može dovesti do progresije gingivitisa u težu formu oboljenja^{7,8}. Takođe, ortodontsko pomeranje zuba u apikalnom smeru može dovesti do pomeranja supragingivalnog plaka subgingivalno i povećati rizik od nastanka destruktivnog parodontitisa⁹. U ovom smislu mali, ali statistički značajan gubitak pripojnog epitela je pronađen kod pacijenata neposredno po završetku ortodontske terapije¹⁰. Činjenica je da sprovođenje ortodontske terapije ima za cilj i unapređenje zdravlja parodonticijuma, i na taj način poboljšanje dugotrajnosti zuba^{5,11}. Na osnovu toga mnogi autori ukazuju da su odrasle osobe sa netretiranim malokluzijama podložnije većem riziku za nastanak parodontalnih oboljenja nego one koje su ortodontski tretirane.

U longitudinalnoj studiji koju su sproveli Alstad i Zachrisson¹² upoređivana je grupa od 38 adolescenata sa malokluzijama klase I i klase II kod kojih je izvršena ekstrakcija premolara sa sličnom grupom koja je imala skoro idealnu okluziju, ali nisu pronađene razlike u gubitku pripoja ni pet meseci posle skidanja aparata. Ortodontski pacijenti su bili uključeni u preventivni program za sprovođenje oralne higijene tokom ortodontskog tretmana. Kloehn i Pfeifer¹³ opisuju efekat fiksnih ortodontskih aparata na parodonticijum ukazujući na različiti stepen gingivalne hiperplazije kod većine pacijenata. Hiperplazija se značajno smanjuje 48 sati nakon uklanjanja aparata sa tendencijom daljeg smanjivanja u toku prva četiri meseca retencionog perioda. Autori takođe ukazuju da ortodontsko lečenje ne uzrokuje bilo kakvu ireverzibilnu destrukciju parodonticijuma. Oni navode da postoji direktna veza između oralne higijene i oboljenja parodonticijuma. Mnogobrojne studije pokazuju porast nakupljanja dentalnog plaka i pojavu gingivitisa kod pacijenata sa fiksnim ortodontskim aparatima, koji nastaju kao posledica otežanog uklanjanja dentalnog plaka^{14,15}, izostanaka samočišćenja, smanjenja mehaničkog efekata žvakanja i spiranja pljuvačkom. Neuklanjanje nagomilanog supragingivalnog plaka dovodi do pojave gingivitisa. Sve ovo upućuje na činjenicu da su ovi pacijenti pod većim rizikom za nastanak oboljenja gingive, periodoncijuma i za pojavu karijesa. To se može sprečiti svakodnevnim pravilnim i redovnim uklanjanjem dentalnog plaka¹⁶.

The effect of fixed orthodontic appliances on gingival health

Given the fact that orthodontic therapy is commonly done during adolescence, the long-term treatment effects on periodontal health are still unclear. Clinicians have divided opinions on the association of orthodontic treatment and periodontal status. Some authors claim there is no permanent periodontal damage as the result of orthodontic treatment^{3,4} whereas others believe that orthodontic treatment may lead to the initial stage of marginal periodontitis.^{5,6} The link between orthodontic therapy and periodontal disease may be established if orthodontic rings contribute to accumulation and difficult removal of subgingival plaque when there is a progression of gingivitis towards more severe forms of disease.^{7,8} Furthermore, orthodontic movement of teeth in the apical direction may result in the dislocation of supragingival plaque subgingivally and an increased risk for destructive periodontal disease.⁹ In this respect, small but statistically significant loss of marginal epithelium was found in patients after orthodontic therapy.¹⁰ The fact is that orthodontic treatment is also aimed at improving periodontal health which would lead to the longevity of the tooth.^{5,11} Based on this, many authors state that adults with untreated malocclusions are at greater risk for periodontal disease than those with treated ones.

In a longitudinal study by Alstad and Zachrisson¹², a group of 38 adolescents with malocclusion classes I and II who had their premolars extracted was compared to a similar group with almost ideal occlusion, but there were no differences in epithelial loss even five months after appliance removal. Orthodontic patients were involved in a preventive programme for oral hygiene maintenance during orthodontic therapy. Kloehn and Pfeifer¹³ described the effect of orthodontic appliances on periodontium with different intensities of gingival hyperplasia in most patients. Hyperplasia was significantly reduced after 48 h after appliance removal with a tendency of further reduction during the first four months of the retention period. The authors also suggested that orthodontic treatment did not induce any irreversible periodontal destruction. They stated there was a direct link between oral hygiene and periodontal disease. Many studies showed increased plaque accumulation and gingivitis in patients with fixed orthodontic appliances due to more difficult plaque removal^{14,15}, the lack of self-cleansing, reduced mechanical effects of chewing and salivary irrigation. If accumulated supragingival plaque is left undisturbed, it will lead to gingivitis. All this implies that these patients are at greater risk for gingival and periodontal disease and caries. It can be prevented by regular daily plaque removal.¹⁶

Održavanje oralne higijene tokom ortodontskog tretmana

Efikasno uklanjanje dentalnog plaka i pridržavanje datim instrukcijama za održavanje oralne higijene su veoma važni parametri i za ortodonte i za parodontologe¹⁷. Pozitivni efekti ortodontskog tretmana mogu biti dovedeni u pitanje ako se ne sprovodi adekvatna i redovna oralna higijena. Efikasna kontrola dentalnog plaka podrazumeva razvijanje više efektivnih metoda¹⁸ i instrumenata^{19,20} za uklanjanje plaka, materijale i metode da se poboljša otpornost zuba i oralnih tkiva na pojavu karijesa i gingivitisa²¹⁻²³, kao i razvoj i primenu programa instrukcija za održavanje oralne higijene²⁴. Sprovođenje dobre oralne higijene i sprečavanje akumulacije dentalnog plaka se postiže primenom mehaničkih i hemijskih sredstava. Da bi se sproveda adekvatna oralna higijena neophodna su: adekvatna sredstva (pribor), pravilna tehnika korišćenja tih sredstava, dovoljna učestalost pranja i dovoljna dužina svakog pojedinačnog pranja zuba. Osnovna sredstva za održavanje oralne higijene su četkice za zube i sredstva za čišćenje aproksimalnih prostora. Pomoćna sredstva za održavanje oralne higijene su paste za zube i različiti rastvori za ispiranje usta (hemijska sredstva).

Dva su glavna faktora koje ortodont treba da uzme u obzir da bi odlučio koja sredstva za održavanje oralne higijene treba da preporuči pacijentu : specifične potrebe pacijenta (podložnost nastanku oboljenja, stanje u ustima) i individualne karakteristike (uzrast, sklonosti, manuelna spretnost, stil života). Da bi održavanje oralne higijene bilo idealno u kućnim uslovima sve ovo treba prilagoditi svakom pacijentu pojedinačno²⁵.

Principi za određivanje odabira sredstava za održavanje oralne higijene:

1. Informacije i preporuke od svih terapeuta treba da budu slične;
2. Treba preporučiti sva raspoloživa sredstva za održavanje oralne higijene;
3. Za svako sredstvo treba da bude objašnjen i demonstriran način upotrebe;
4. Sredstva treba da budu dostupna u ordinaciji za demonstraciju , kao i za pacijente.
5. Kod mlađih pacijenata uključiti roditelje u sve preporuke i instrukcije.

Sledeća lista dostupnih sredstava uključuje preporuke za ortodontske pacijene.

Oral hygiene during orthodontic treatment

Efficient removal of dental plaque and following the instructions for adequate oral hygiene are very important parameters for both orthodontists and periodontists.¹⁷ Positive effects of orthodontic treatment may be jeopardized if adequate and regular oral hygiene is not maintained. Efficient plaque control consists of developing several effective methods¹⁸ and instruments^{19,20} for plaque removal, materials and methods for improving the resistance of teeth and oral tissues to caries and gingivitis²¹⁻²³, as well as instructions for oral hygiene maintenance.²⁴ Adequate oral hygiene and prevention of dental plaque accumulation are achieved by mechanical and chemical devices and agents. The following items are necessary for adequate oral hygiene: adequate equipment, proper technique, frequency of tooth brushing and adequate length of individual tooth brushing action. Main items for oral hygiene are tooth brushes (mechanical devices) and devices for cleansing proximal areas. Additional devices for oral hygiene are toothpastes and various mouth washes (chemical agents).

Two main factors that an orthodontist must take into consideration in order to decide which devices to recommend are: patient's specific needs (risk for certain disease, life style) and individual characteristics (age, attitudes, manual ability, life style). All these must be adapted for each individual patient in order to achieve ideal oral hygiene in domestic environment.²⁵

The principles for selection of oral hygiene devices and agents are:

1. Information and recommendations from all therapists should be similar;
2. All available devices and agents should be recommended;
3. For each device and agent, the technique should be detailed and demonstrated;
4. Parents should be involved in all recommendations and instructions given to young patients.

The following list of available devices and agents includes recommendations for orthodontic patients.

Mehanička sredstva za održavanje oralne higijene

Četkice za zube sa mekim zaobljenim najlonskim vlaknima su efikasne kada se koriste gingivalno iznad bravica i lukova, sa vlaknima postavljenim pod uglom nasuprot gingivalnoj ivici. Ribajuća ili Bass-ova tehnika koja koristi horizontalne, kratke odmerene pokrete sa umerenim pritiskom, daje najbolje rezultate¹⁸. Pacijentima treba savetovati da modifikuju tehniku pranja zuba po uklanjanju aparata, jer pranje zuba sa velikim intenzitetom pritiska može dovesti do oštećenja gleđi i gingive (Slika 1).



Mechanical devices for oral hygiene maintenance

Tooth brushes with soft round nylon fibres are efficient gingivally above brackets and arches with fibres directed at an angle towards the gingival margin. Bass's technique which uses horizontal, short and controlled movements with moderate pressure gives the best results.¹⁸ Patients should be advised to modify the brushing technique after the appliance removal, because brushing teeth with high pressure may lead to enamel and gingival destruction (Figure 1).

Slika 1. Četkica za zube
Figure 1. Tooth brush

Ortodontske četkice imaju vlakna postavljena u obliku slova V da bi bile efikasne u čišćenju oko bravica. Treba primenjivati ribajuću ili Bass-ovu tehniku. Nalaz jedne studije ukazuje da su kod uklanjanja plaka sa labijalnih površina prednjih zuba ortodontske četkice efikasnije nego obične²⁶ (Slika 2).



Orthodontic brushes have V-shaped fibres in order to be effective round the brackets. Bass's technique should be applied. A study has shown that orthodontic brushes are better for labial surfaces of anterior teeth compared to regular brushes (Figure 2).²⁶

Slika 2. Ortodontska četkica
Figure 2. Orthodontic brush

Četkice za čišćenje sulkusa „End tufted brush“ mogu biti korisne za čišćenje ivica gingive oko zuba i teže dostupnih mesta ispod lukova ligatura terminalnih molara. Preporučuju se kod pacijenata koji imaju problema sa parodontcijumom, ali zahtevaju veći stepen manuelne spretnosti²⁷ (Slika3).



Brushes for sulcus cleansing, „End tufted brush“, may be suitable for gingival margins around teeth and less accessible areas under the arch ligatures of terminal molars. They are recommended for patients with periodontal problems but require better manual ability (Figure 3).²⁷

Slika 3. „End tufted brush“
Figure 3. „End tufted brush“

Električne četkice za zube su efikasne²⁸ sa obzirom na činjenicu da su studije na ortodontskim pacijentima dale oprečne rezultate. Studija koju su sproveli Womack i saradnici pokazala je da električne četkice imaju veću efikasnost nego obične²⁹, ali studija koju je sproveo Kobayashi zaključuje da su podjednako efikasne³⁰. Da bi se uklonio plak sa gingivalne margine radni deo četkice treba postaviti pod uglom nasuprot gingivalnoj ivici, bukalno i lingvalno. Čišćenje ispod i oko bravica je najefikasnije kada su vlakna usmerena koso ispod i oko bravica. Električne četkice za zube imaju glavu manju od glave klasičnih četkica, a glave su izmenjive (Slika 4).

Electric brushes are efficient²⁸ although studies involving orthodontic patients gave discordant results. A study by Womack et al. showed that electric brushes had greater effectiveness than conventional ones²⁹, but a study by Kobayashi concluded they were equally efficient.³⁰ In order to remove dental plaque from the gingival margin, the working part of a tooth brush should be at an angle against the gingival margin, buccally and lingually. Brushing around and under the brackets is most efficient when fibres are directed oblique. Electric tooth brushes have a smaller head than conventional ones and the heads are changeable (Figure 4).



Slika 4. Električna četkica za zube
Figure 4. Electric tooth brush

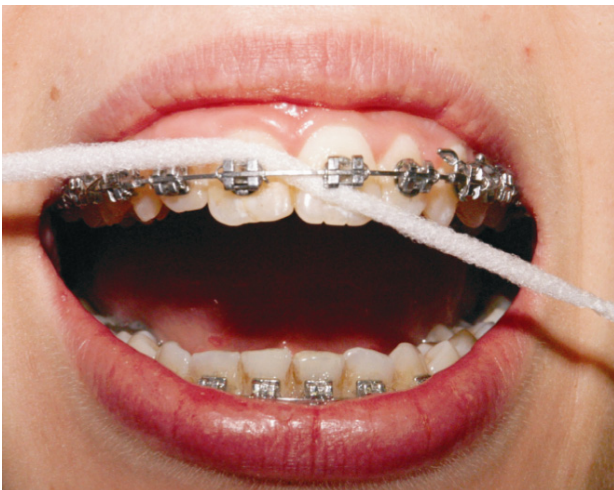
Za pacijente sa širokim međuzubnim prostorima postoji veliki izbor interdentalnih četkica, uključujući setove za putovanja, sa dužim i kraćim glavama i četkice različitih oblika i prečnika koje se mogu menjati na jednom držaču. Interdentalne četkice se mogu koristiti i za čišćenje regije oko bravica, uklanjanje plaka sa bukalnih površina zuba gde se zbog položaja ortodontskih lukova ne može pristupiti drugim četkicama, kao i za interproksimalnu aplikaciju fluorida u obliku tečnosti ili gelova, dok pacijenti mogu četkati zube vertikalno ispod lukova²⁷ (Slika 5).



For patients with wide edentulous areas there is a vast range of interdental brushes, including travel sets with long or short heads and brushes of various shapes and diameters which can be changed on a single holder. Interdental brushes may be used to clean areas round the brackets, remove dental plaque from buccal surfaces which are not accessible for other brushes due to the position of orthodontic arches as well as to apply fluoride gels or liquids interproximally whilst patients can brush teeth vertically under the arches (Figure 5).²⁷

Slika 5. Interdentalna četkica
Figure 5. Interdental tooth brush

Za čišćenje oko bravica i ispod ortodontskih lukova može se koristiti i superkonac (superfloss) sa podebljanim sunderastim delom za čišćenje (Slika 6).



Also, superfloss with thickened spongy cleaning surface may be used for areas round the brackets and under the orthodontic arches (Figure 6).

Slika 6. Superfloss
Figure 6. Superfloss

Hemijska sredstva

Hemijska sredstva za neutralizaciju plaka deluju tako što svojim antibakterijskim delovanjem sprečavaju stvaranje dentalnog plaka. Ova sredstva se nalaze u vidu rastvora za ispiranje usta, gelova, a dodaju se i pastama za zube. Najpoznatija sredstva su hlorheksidin diglukonat i fluoridi. Ova sredstva nikako ne mogu da zamene standardna mehanička sredstva za održavanje oralne higijene. Hemioterapija ima sekundarnu ulogu, kompletirajući ostale metode primenjene u prevenciji oboljenja parodontijuma³¹. Izbor hemijskih sredstava bi trebalo da bude individualan, upotreba vremenski ograničena i samo po preporuci stomatologa.

Hlorheksidin je antimikrobni katjonski bisbiguanid koji u svojoj aktivnoj formi poseduje jedinstvenu osobinu da se može adsorbovati na oralna tkiva. Vezuje se za hidroksiapatit, površine zuba, oralnu sluzokožu i salivarne mucine za duži period vremena, a oslobađa se kada njegova koncentracija u usnoj duplji opadne. Njegova adsorpcija i lagano otpuštanje omogućavaju antimikrobni efekat i sprečavanje rekolonizacije bakterija oko 24 časa^{32,33}. Proučavanjem hlorheksidina utvrđeno je da deluje na gram pozitivne, gram negativne bakterije, gljivice, fakultativno aerobne i anaerobne mikro-organizme³⁴.

Fluoridi (anioni) se koriste u prevenciji karijesa i jačanju strukture zuba³⁵. Tokom razvoja zuba i po nicanju bitno je prisustvo fluora kako bi se formirao fluoroapatit. Fluoroapatit je otporniji na dejstvo kiselina (demineralizaciju) od hidroksiapatita. Pošto je u jonskoj formi, toksičan je za *Streptococcus mutans* u visokim koncentracijama, dok niskim koncentracijama ispoljava antienzimatski efekat. Inhibicijom enzima smanjuje sposobnost *Streptococcus mutans* za produkciju kiselina i metabolizam glukoze.

McDermid i saradnici³⁶ su uočili da kombinacija sredstava koja imaju antikariogeno i antiplak dejstvo može biti korisna i obezbediti dodatni zaštitni efekat, ako svaka supstanca deluje na različite prouzrokovaoče oboljenja. Kombinacija hlorheksidina i fluorida u sredstvima za oralnu higijenu može doprineti u sprečavanju nastanka karijesa i gingivitisa³⁷. Hlorheksidin ima inhibični efekat na formiranje plaka i produkciju kiselina, što znatno smanjuje kariogeni potencijal i tako povećava efekat fluorida³⁸. Uprkos njihovom suprotnom naelektrisanju mogu se uspešno kombinovati, bez narušavanja njihovih individualnih efekata³⁹.

Kombinacijom hlorheksidina i fluorida se ostvaruje veći baktericidni efekat na strukturu *Streptococcus mutans* nego kada deluju pojedinačno⁴⁰. Utvrđeno je da kada se natrijum fluorid i hlorheksidin koriste u istom preparatu ne dolazi do smanjenja prisustva slobodnih jona fluorida i njegove zaštitne uloge koju ima na gleđ zuba⁴¹ niti se redukuje količina hlorheksidina ispod terapijskog nivoa³⁶.

Chemical agents

Chemical agents for plaque neutralisation prevent the formation of dental plaque based on their antibacterial action. These agents are available as mouth rinses, gels and they are added to toothpastes. The best known agents are chlorhexidine digluconate and fluorides. These agents cannot replace standard mechanical devices for oral hygiene maintenance. Chemotherapy has a secondary role, completing the other methods in the prevention of periodontal disease.³¹ The choice of chemical agents should be individual, time limited and recommended by a dentist.

Chlorhexidine is an antimicrobial cationic bisguanid which may be adsorbed to oral tissues in its active form. It binds to hydroxyapatite, tooth surfaces, oral mucosa and salivary mucin for a long period of time and is released when its concentration in the oral cavity decreases. Its adsorption and slow release enable antimicrobial effect and prevent bacterial re-colonisation for 24 h.^{32,33} Chlorhexidine has been proved to be effective against gram positive, gram negative bacteria, fungi, facultative aerobes and anaerobes.³⁴

Fluorides (anions) are used in caries prevention and strengthening tooth structure.³⁵ During tooth development and after eruption, the presence of fluorides is essential for the formation of fluoroapatite. This compound is more resistible to acid attacks (demineralisation) than hydroxyapatite. Being in its ionic form, it is toxic for *S. mutans* in high concentrations whereas it exhibits antienzymatic effect in low concentrations. Inhibition of enzymes reduces the ability of *S. mutans* to produce acids and metabolise glucose.

McDermid et al.³⁶ reported that the combination of anticariogenic and antiplaque devices may be efficient and provide an additional protective effect, if each substance acts against the cause of the disease. The combination of chlorhexidine and fluorides in products for oral hygiene may contribute to the prevention of caries and gingivitis.³⁷ Chlorhexidine has an inhibitory effect on plaque formation and acid production, which significantly reduces its cariogenic potential and increases the effect of fluorides.³⁸ despite their opposite charge, these substances may be efficiently combined, without losing their individual effects.³⁹ Chlorhexidine-fluoride combination has a more prominent bactericidal effect against *S. mutans* than each substance individually.⁴⁰ It has been suggested that sodium fluoride and chlorhexidine in a single unit neither reduce free fluoride anions and their protective role for enamel⁴¹ nor the amount of chlorhexidine drops below a therapeutic level.³⁶

U studiji koju su sproveli Dolles i saradnici⁴², utvrđeno je da kada su 2.0% hlorheksidin i 0.1% NaF korišćeni zajedno u pasti za zube, NaF se mogao u potpunosti izolovati. Ova činjenica navodi na zaključak da su ostali sastojci paste više nego NaF reagovali i vezivali se sa hlorheksidinom. Natrijum lauril sulfat, deterdžent anjonskog karaktera koji se najčešće koristi u pastama za zube se vezivao sa hlorheksidinom i neutralisao njegovo dejstvo. Do ovog negativnog dejstva dolazi zbog jonske interakcije⁴³, ali do danas nisu utvrđene reakcije između NaF i hlorheksidina. Pozitivan efekat hlorheksidina se postiže kada se pasta za zube (natrijum lauril sulfat) i tečnost za ispiranje usta sa hlorheksidinom koriste u razmaku od najmanje 30 minuta, a idealno bi bilo u intervalu od 120 minuta⁴¹. Štetan efekat hlorheksidina je prebojavanje zuba i ovo je razlog zašto hlorheksidin nije našao komercijalnu primenu u preparatima za dugotrajnu upotrebu.

Osobe koje imaju najviše koristi od korišćenja kombinacije hlorheksidina i fluorida su osobe visokog karijes rizika kao što su deca, pacijenti u nekom terapijskom režimu koji nosi povećan rizik za nastanak karijesa i gingivitisa³⁹, pacijenti pod terapijom zračenjem i medicinski kompromitovane osobe⁴⁴.

Preventivni programi

Organizovano sprovođenje preventivnih mera u rizičnim grupama označava se kao individualni preventivni program. Posebnu pažnju u toku individualnog preventivnog rada treba posvetiti osobama sa visokim rizikom za nastanak oboljenja parodonticijuma. U takvim uslovima individualni preventivni program bi predstavljao određivanje preventivnog režima specifičnog za individualni stepen rizičnosti⁴⁵. Za sve oblike individualnog rada značajno je intenzivno, aktivno zdravstveno-vaspitno delovanje uz primenu svih poznatih motivacionih tehnika. Od značaja su raznovrstan način komunikacije prilagođen uzrastu i psihološkom tipu osobe, audiovizuelna metodologija, a za mlađe uzraste i aktivno uključivanje roditelja. Neophodna je česta remotivacija zbog poznatog brzog gubljenja početnih rezultata. Za pacijente sa fiksnim ortodontskim aparatima je neophodno sprovesti mere u vidu individualnih preventivnih programa, koji pored zdravstvenog vaspitanja obuhvataju i informisanje pacijenata o značaju redovnog i pravilnog održavanja oralne higijene kao i važnosti kontrolnih pregleda. Stav mnogih autora je da decu kod kojih se sprovodi tretman fiksnim ortodontskim aparatima treba uključiti u preventivni program sa ciljem prevencije i supresije stvaranja dentalnog plaka.⁴⁶⁻⁴⁸ Mada odgovor parodontalnog tkiva domaćina može biti dovoljan da se suprotstavi agresivnim faktorima bakterijskog plaka u toku ortodontskog lečenja, ne smeju se potceniti preventivno profilaktičke mere koje se sprovode u toku ovog lečenja.

A study by Dolles et al.⁴² showed that, when 2.0% chlorhexidine and 0.1% NaF were used in a toothpaste, NaF was completely identifiable. This fact leads to a conclusion that other toothpaste ingredients reacted with chlorhexidine more than NaF. Sodium lauryl sulphate, an anionic detergent, most often used in toothpastes reacted with chlorhexidine and neutralised its effect. This negative outcome was due to ionic interaction⁴³, but there has been no proven interaction between NaF and chlorhexidine to date. The positive effect of chlorhexidine is enabled when toothpaste (Sodium lauryl sulphate) and mouth wash are used with an intermediate period of minimum 30 min, or up to 120 min ideally.⁴¹ A negative effect of chlorhexidine is tooth discoloration and that is why chlorhexidine has not reached commercial application in products for long-term use.

Individuals at high risk for caries (children, patients on a treatment regime which promotes caries and gingivitis, chemotherapy and medically compromised patients) have the greatest benefit from the combination of chlorhexidine and fluorides.^{39,44}

Preventive programmes

Organised preventive measures in risk groups are classified as individual preventive programmes. Special attention in individual preventive work should be given to individuals at high risk for periodontal disease. In such cases, individual preventive programme consists of determining preventive regime specific for an individual level of risk.⁴⁵ For all forms of individual work, intensive, active health education with all known motivational techniques is essential. Also important are diversity in communication which is adapted for individual's age and psychological profile, audiovisual methodology and parental involvement with children. Frequent re-motivation is necessary due to the loss of initial results. For patients with fixed orthodontic appliances, individual preventive programmes are necessary, which comprise not only health education but also information on the importance of regular and adequate oral hygiene and check-ups. Many authors suggested that children with fixed orthodontic appliances should be included in the preventive programme aimed at prevention and suppression of plaque formation.⁴⁶⁻⁴⁸ Although periodontal tissue response may be sufficient to neutralise aggressive factors from bacterial plaque during orthodontic treatment, preventive and prophylactic measures must not be underestimated.

Zaključak

Tretman fiksnim ortodontskim aparatima pruža funkcionalnu i estetsku rehabilitaciju, ali sa druge strane zahteva veliku odgovornost pacijenata. Pre početka tretmana treba predočiti mogućnost povećanog rizika za nastanak karijesa i oboljenja parodonticijuma i neophodnost besprekornog i redovnog održavanja oralne higijene, kako bi rizike sveli na najmanju moguću meru. Izbor pacijenata, edukacija i obuka o redovnom i pravilnom održavanju oralne higijene udružena sa preventivno-profilaktičkim merama neće samo pomoći pacijentima da vreme dok su pod ortodontskom terapijom prođe komfornije, već će doprineti funkcionalnom i estetskom uspehu terapije. Uspostavljanje navike pravilnog održavanja oralne higijene je od velike koristi za očuvanje zdravlja gingive do kraja ortodontske terapije, a i po njenom završetku. Osim pravilnog zubnog niza očuvajuće se zdravlje gingive i steći dobre navike održavanja pravilne i redovne oralne higijene za ceo život.

Conclusion

Treatment with fixed orthodontic appliances offers functional and aesthetic rehabilitation but, on the other hand, requires patients' full responsibility. Before commencing the treatment, patients should be informed about increased risk for caries and periodontal disease and the necessity for ultimate and regular oral hygiene in order to reduce this risk to the minimum. Patient selection, education and teaching about regular and adequate oral hygiene maintenance associated with preventive-prophylactic measures will not only make the treatment more comfortable, but also contribute to functional and aesthetic treatment success. The habit to maintain oral hygiene regularly is of great importance for maintaining gingival health throughout the treatment and after it is completed. Beside a regular dental arch, gingival health will be secured and favourable habits acquired for life.

Literatura / References

1. *Florman M.* Soft-tissue maintenance during orthodontic treatment.
2. *Ellis Pe, Benson Pe.* Potential hazards of orthodontic treatment-What your patient should know. *Dent Update* 2002; 29:492-6.
3. *Rateitschak KH.* Ortodontics and periodontology *Int Dent J* 1968; 18: 108.
4. *Kloehn JS, Pfeifer JS.* The effect of orthodontic treatment on the periodontium. *Angle Orthod* 1974; 44: 127-34.
5. *Kessler M.* Interrelationships between orthodontics and periodontics. *Am J Orthod* 1976; 70: 154-72.
7. *Norton L.* Periodontal considerations in orthodontic treatment. *Dent Clin North Am* 1981; 25: 117-30.
8. *Zachrisson S, Zachrisson BU.* Gingival condition associated with orthodontic treatment. *Angle Orthod* 1972; 42:26-34.
9. *Tersin J.* Studies of gingival conditions in relation to orthodontic treatment.II Changes in amounts of gingival exudate in relation to orthodontic treatment. *Swed Dent J* 1975; 68: 102-210
10. *Ericsson IB, Thaliander B, Lindhe J, Okamoto H.* The effect of orthodontic tilting movements on the periodontal tissues of infected and non-infected dentitions in dogs. *J Clin Periodontol* 1977; 4:278-93.
10. *Zachrisson B, Almaes L.* Periodontal condition in orthodontically treated and untreated individuals. I Loss of attachment, gingival pocket depth and clinical crown height. *Angle Orthod* 1973; 43:402-11
11. *Lusterman EA,* Clinical significance of periodontic orthodontic interrelationships. *N.Y. State Dent.J.* 1974; 40:147-56.
12. *Alstad S, Zachrisson B W.* Longitudinal study of periodontal condition associated with orthodontic treatment in adolescents. *Am J Orthod* 1979; 76:277-86.
13. *Kloehn J S, Pfeifer J S.* The effect of orthodontic treatment on the periodontium. *Angle Orthod* 1974; 44:127-34.
14. *Zachrisson BU, Zachrisson S.* Caries incidence and oral hygiene during orthodontic treatment. *Scand J Dent Res* 1971; 79:394-401.
15. *Boyd.R.L. Chun Y.S.* Eighteen- month evaluation of the effects of a 0.4% stannous fluoride gel on gingivitis in orthodontic patients. *AJO-DO* 1994; Jan 35-41.
16. *Lang NP, Cumming BR, Loe H.* Toothbrush frequency as it is related to plaque development and gingival health. *J Periodontol* 1973; 44:396.
17. *Rinchuse D, Rinchuse D, Zullo T.* Oral Hygiene Compliance: A clinical investigation. *JCO* 1992; Jan: 33-8.
18. *Zachrisson BU.* Oral hygiene for orthodontic patients. Current concepts and practical advice. *Am J Orthod* 1974; 66: 487-97.
19. *Boyd R L, Murray P, Robertson P B.* Effect of rotary electric-toothbrush versus manual toothbrush on periodontal status during orthodontic treatment. *Am J Orthod* 1989; 96: 342-7.

20. Mueller LJ, Darby ML, Allen DS Tolle SL. Rotary electric toothbrushing- clinical effects on the presence of gingivitis and supragingival dental plaque. *Dent Hyg* 1987; 64: 546.
21. Casey GR. Maintenance of oral hygiene and dental health during orthodontic therapy. *Clin Prev Dent* 1988; 10:11-3.
22. Bandtzaeg P. Local factors of resistance in the gingival area. *J Periodontol Res* 1966; 1: 1942
23. Wolff L F et al. Effect of toothbrushing with 0.4% stannous fluoride and 0.22% sodium fluoride gel on gingivitis for 18 months. *J Am Dent Assoc* 1989; 199:283-9.
24. Schwaninger B, Vichers- Schwaninger N. Developing an effective oral hygiene program for the orthodontic patient. Review rationale and recommendations. *Am J Orthod* 1979; 75: 447-52.
25. Lorri J B, Connie L S. Effective oral hygiene for orthodontic patients. *JCO* 1990; May: 315-20.
26. Williams P. et al. A clinical trial of an orthodontic toothbrush. *Eur J Orthod* 1987; 9: 295-304.
27. Gjermo P, Flotra L. The effects of different methods of interdental cleaning. *J Periodont Res* 1970; 5: 230-6.
28. Smith W A, Ash M M. A clinical evaluation of an electric toothbrush. *J Periodontol* 1964; 35: 127.
30. Womack W R, Guay A H. Comparative cleansing efficiency of an electric and a manual toothbrush in orthodontic patients. *Angle Orthod* 1968; 38: 256-67.
31. Kobayashi Y L, Ash M M. Evaluation of an electric toothbrush on orthodontic patients. *Angle Orthod* 1964; 34: 209-19.
32. Feliu JL. Long-term benefits of orthodontic treatment on oral hygiene. *Am J Orthod* 1982;82(6):473-7.
33. Petersson LG, Magnusson K, Andersson H, Deierborg G, Twetman S: Effect of semi-annual applications of a chlorhexidine/fluoride varnish mixture on approximal caries incidence in schoolchildren. A three-year radiographic study. *Eur J Oral Sci* 1998; 106: 623-7.
34. Prayitno S, Addy M. An in vitro study of factors affecting the development of staining associated with the use of chlorhexidine. *J Periodontal Res* 1979; 14: 397-402.
35. Emilson C. Susceptibility of various microorganisms to chlorhexidine. *Scand J Dent Res* 1977; 85: 255-65.
36. Hamilton IR. Effects of fluoride on enzymatic regulation of bacterial carbohydrate metabolism. *Caries Res* 1977; (suppl 1): 262-91.
37. McDermid AS, Marsh PD, Keevil CW, Et. Al. Additive inhibitory effects of combinations of fluoride and chlorhexidine on acid production by *Streptococcus mutans* and *Streptococcus sanguis*. *Caries Res* 1985; 19: 64-71.
38. Ullsfoss BN, Ogaard B, Arends J, Ruben J, Et. Al. Effect of a combined chlorhexidine and NaF mouthrinse: an in vivo human caries model study. *Scand J Dent Res* 1994; 102: 109-12.
39. Rolla G, Melsen B. On the mechanism of the plaque inhibition by chlorhexidine. *J Dent Res* 1975; 54: 1357-62.
40. Spets-Happonen S, Luoma H, Forss H, Dentala J, Et. Al. Effects of a chlorhexidine-fluoride-strontium rinsing program on caries, gingivitis and some salivary bacteria among Finnish schoolchildren.. *Scand J Dent Res* 1991; 99: 130-8.
41. Mendieta C, Vallcorba N, Binney A, Et. Al. Comparison of 2 chlorhexidine mouthwashes on plaque regrowth in vivo and dietary staining in vitro. *J Clin Periodontol* 1994; 21: 296-300.
42. Barkvoll P, Rolla G, Svendsen AK. Interaction between chlorhexidine gluconate and sodium lauryl sulfate in vivo. *J Clin Periodontol* 1989; 16: 593-5.
43. Dolles OK, Bonesvoll P, Gamst ON, Gjermo P. Determination of fluoride and chlorhexidine from chlorhexidine/fluoride-containing dentifrices. *Scand J Dent Res* 1979; 87: 115-22.
44. Meurman JH. Ultrastructure, growth, and adherence of *Streptococcus mutans* after treatment with chlorhexidine and fluoride. *Caries Res* 1988; 22: 283-7.
45. Jenkins S, Addy M, Newcombe R. Evaluation of a mouthrinse containing chlorhexidine and fluoride as an adjunct to oral hygiene. *J Clin Periodontol* 1993; 20: 20-5.
46. Janjanin M, Vulović M, Jelača P, i sar. Program preventivne stomatološke zaštite stanovništva Republike Srbije, *Stom Glas S*. 1993; 40: 28-31.
47. Lundström F, Hamp SE. Effect of oral hygiene education on children with and without subsequent orthodontic treatment. *Scand J Dent Res* 1980; 88:53-9.
48. Lundström F, Hamp SE, Nyman S. Systemic plaque control in children undergoing long- term orthodontic treatment. *Eur J Orthod* 1980; 2:27-39.
49. Boyd RL. Longitudinal evaluation of a system for self-monitoring plaque control effectiveness in orthodontic patients. *J Clin Periodontol* 1983; 10:380-8.

Adresa za korespondenciju

Sava Matić
 Prespanska 11, 11050 Beograd
 Tel. 0641429577
 E-mail: sava.matic@gmail.com

Address for correspondence

Sava Matić
 Prespanska 11. street, 11050 Belgrade
 Tel. 0641429577
 E-mail: sava.matic@gmail.com