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Stanje oralne sluznice kod nositelja ortodontskih naprava

Oral Mucosa Status of Patients Undergoing Orthodontic Treatment

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Sažetak

Svrha istraživanja bila je ispitati koliko je česta upala sluznice tijekom ortodontske terapije s obzirom na stupanj higijene i vrstu ortodontske naprave. **Ispitanici i postupci:** Sudjelovalo je 110 djece u dobi od 6 do 18 godina - 60 je imalo fiksne ili mobilne ortodontske naprave, a u kontrolnoj skupini bilo ih je 50 tek upućenih na ortodontsko liječenje. Primjenom verificiranih kliničkih testova svima je bio određen stupanj oralne higijene, stupanj upale gingive i intezitet upale sluznice. **Rezultati:** Učestalost i intezitet upale gingive bio je obrnuto proporcionalan stupnju oralne higijene ($p < 0,05$). Lošiju oralnu higijenu imali su ispitanici u kontrolnoj skupini. Jače upalne promjene bile su uočene samo kod malobrojnih nositelja fiksnih ortodontskih naprava. Nije bila dokazana statistički znatna povezanost između upale sluznice i vrste ortodontske naprave. **Zaključak:** Rezultati pokazuju da nositelji ortodontskih naprava imaju bolju oralnu higijenu i rjeđe upaljenu sluznicu negoli oni u kontrolnoj skupini.

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Ključne riječi

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Uvod

Tijekom ortodontskog liječenja mogu se na sluznici usne šupljine pojaviti različite lezije. Prema podacima iz literature učestalost takvih promjena je varijabilna i ovisi o nizu čimbenika kao što su spol, dob, motivacija pacijenta, psihofizički razvoj, stupanj oralne higijene, utjecaj stomatoloških legura, ili sklonost oralnim parafunkcijama (1-3).

Introduction

Changes on oral mucosa and in dental tissues of some patients occur in the course of orthodontic treatment. The frequency of such changes, according to data from literature, varies and depends on a number of factors such as sex, age, a patient's motivation, physical and mental development, oral hygiene degree, the effect of dental alloys and tendency to oral parafunctions (1-3).

Dok traje fiksno ortodontsko liječenje povećana je incidencija karijesa i gingivitisa, a tome pridonosi nakupljanje i zadržavanje plaka oko bravica (4). Retenciju plaka potiču i površinske karakteristike ortodontske naprave i hrapavost materijala (5). Neželjen učinak fiksnih ortodontskih naprava jest i iritacija sluznice usne šupljine. Premda su lezije sluznice bolne i neugodne, obično brzo zacjeljuju (6).

Najčešće opisane promjene na sluznici usne šupljine uzrokovane mikrotraumom (kontaktnom iritacijom) zbog ortodontske naprave su zadebljanja epitela i erozije sluznice, a rjeđe je javljaju opsežnije ulceracije (7-9). Tijekom ortodontskog liječenja češće se uočava infekcija sluznice virusom Herpes simplex negoli recidivi aftoznih ulceracija (10). Opisan je i bijeli spužvasti nevus kod nositelja ortodontskih naprava (6). Novija istraživanja upućuju na oštećenja sluznice prouzročena stomatološkim legurama, a opisane su promjene u obliku diskoloracije i hiperplazije gingive. Neke promjene nastaju kao alergijske reakcije na metalne ione, a klinički su im znakovi pečenje sluznice, ljuštenje, angularni heilitis i eritemi multiforme (11).

Budući da je malo podataka o oštećenjima sluznice kod djece koju ortodonti redovito nadziru i motivirana su za liječenje, svrha ovog istraživanja bila je ispitati koliko su česte upalne promjene na sluznici usne šupljine kod djece nositelja fiksnih i mobilnih ortodontskih naprava te povezanost sa stupnjem oralne higijene i vrstom ortodontske naprave.

Materijali i metode

Istraživanjem je bilo obuhvaćeno 110 djece u dobi od 6 do 18 godina. Stomatološki pregled bio je obavljen u specijalističkim ortodontskim ordinacijama u Slavonskom Brodu i Šibeniku. Ispitnu skupinu činilo je 60 sudionika - 27 djevojčica i 33 dječaka srednje dobi 13,25 godina. Svi su bili u postupku ortodontskog liječenja i redovito su ih nadzirali ortodonti - 18 ispitanika imalo je mobilne bimaksilarne ortodontske naprave, 24 su bili nositelji mobilnih monomaksilarnih naprava, a 18 fiksnih ortodontskih naprava. Tijekom kontrolnog pregleda pregledali su ih i ortodonti i specijalisti oralne medicine te su zabilježili sve promjene u usnoj šupljini.

The incidence of caries and gingivitis is increased in the course of fixed orthodontic treatment due to accumulation and retention of plaque around the brackets (4). Surface characteristics of orthodontic appliances and material roughness also contribute to plaque retention (5). Also, an adverse effect of fixed orthodontic appliances is irritation of oral mucosa. Although the lesions of oral mucosa are painful and uncomfortable, they usually heal fast (6).

The most commonly described changes on oral mucosa caused by friction-related micro trauma (contact irritation) by orthodontic appliance are thickening of the epithelium and mucosal erosions, whereas more extensive ulcerations occur less frequently (7-9). In the course of orthodontic treatment, herpes simplex occurs more commonly than recurrent aphthous ulcerations (10). The occurrence of white sponge nevus has also been described in wearers of orthodontic appliances (6). Some recent studies have investigated the influence of dental alloys on damage to oral mucosa such as gingival discoloration and hyperplasia. Some changes are caused by allergic reaction to metal ions, which clinically manifest as mucosal burning and desquamation, angular cheilitis and erythema multiforme (11).

Since there is little information on damages to oral mucosa in children regularly controlled by orthodontists and motivated for orthodontic treatment, the aim of this study was to examine the frequency of inflammatory changes in oral mucosa of children with wearers of fixed and removable orthodontic appliances and to the relationship to the degree of oral hygiene and the type of orthodontic appliance.

Materials and Methods

The study included a group of 110 children aged between 6-18 years. Dental examinations were carried out in orthodontic dental practices in Slavonski Brod and Šibenik. The treatment group comprised 60 subjects, 27 girls and 33 boys, mean age 13.25. Children in the treatment group were orthodontically treated and regularly checked up by the orthodontist: 18 subjects were wearers of removable bimaxillary orthodontic appliances, 24 subjects were wearers of removable monomaxillary appliances and 18 subjects were wearers of fixed orthodontic appliances. During their regular orthodontic check ups, they were examined by orthodontist and oral medicine specialists who registered changes on oral mucosa.

Kontrolnu skupinu činilo je 50 djece - 24 djevojčice i 26 dječaka srednje dobi 11,86 godina. Nisu imali ortodontske naprave i prvi su put došli na pregled ortodontu, a uputio ih je njihov stomatolog ili oralni kirurg.

Istraživanje je odobrilo Etičko povjerenstvo Stomatološkog fakulteta Sveučilišta u Zagrebu. Svaki je ispitanik znao u čemu sudjeluje i zašto, a istraživanje je provedeno nakon suglasnosti roditelja s obzirom na to da se radilo o djeci mlađoj od 18 godina. Trajalo je godinu dana.

Anamnestički podaci svih ispitanika kao i oni dobiveni kliničkim pregledom, upisani su u anketni listić koji je posebno kreiran za to istraživanje (12). Stomatološki pregled bio je obavljen tijekom specijalističkog ortodontskog pregleda i zabilježene su sve uočene upalne promjene na sluznici prema topografskoj shemi Svjetske zdravstvene organizacije (WHO-a) (13) te stupanj oralne higijene.

Stupanj oralne higijene svih ispitanika bio je određen modificiranim indeksom plaka (14):

- 0 = nema naslaga plaka
- 1 = naslage plaka na slobodnom gingivnom rubu i površini zuba - plak se otkriva nakon sondiranja gingivnog ruba parodontnom sondom;
- 2 = umjerene naslage plaka u gingivnom džepu, rubu i/ili na površini zuba, a vidljive su okom;
- 3 = velike naslage plaka u gingivnom džepu i/ili na gingivnom rubu te površini zuba.

Upala gingive određena je prema Löeu i ocijenjena stupnjevima (15):

- 0 = odsutnost upale gingive
- 1 = blaga upala, jedva vidljiva promjena boje, blaga oteklina, kod palpacije nema krvarenja;
- 2 = umjerena upala, crvenilo, oteklina, kod sondiranja se javlja krvarenje;
- 3 = jaka upala, izraženo crvenilo, oteklina, ulceracije te sklonost krvarenju kod sondiranja i pritiska.

Procjena inteziteta upale sluznice usne šupljine obavljena je kliničkim pregledom i ocijenjena stupnjevima od 1 do 3 (16):

- Stupanj 1.- optički vidljiva upalna reakcija, odnosno lokalizirana promjena boje oralne sluznice u crvenu slabog inteziteta i opsega manjeg od 1 centimetra;
- Stupanj 2. - srednji intezitet upalne reakcije, umjereno crvena boja oralne sluznice opsega do 2 centimetra;
- Stupanj 3. - proširena upalna reakcija jakog inteziteta, izrazito crvene boje koja je zahvatila šire područje oralne sluznice veće od 2 centimetra.

The controls comprised 50 subjects: 24 girls and 26 boys, mean age 11.86. Children from the control group did not have orthodontic appliances and they came to orthodontic examination for the first time after having been referred by their general dentist and oral surgeon.

The Ethics Committee School of Dental Medicine, University of Zagreb, approved the study. Each subject was informed about the aim of the study, but since the subjects were under 18, their parents signed a written consent. The examinations of patients of both groups were performed in a period of one year.

Data obtained from all the subjects in the course of taking the medical history and during dental examinations were written down into a questionnaire designed for this study (12). All observed inflammatory changes on oral mucosa were recorded according to a WHO topographic scheme (13). A degree of oral hygiene was also recorded.

The degree of oral hygiene in all subjects was determined by a modified plaque index (14):

- 0 = No plaque in the gingival area
- 1 = A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be recognized only by running a probe across the tooth surface
- 2 = Moderate accumulation of soft deposits within the gingival pocket and on the gingival margin and/or adjacent tooth surface that can be seen by the naked eye
- 3 = Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface

Assessment of gingival inflammation was carried out according and graded to Löe (15):

- 0 = Normal gingiva
- 1 = Mild inflammation, slight change in colour, slight edema, no bleeding on palpation
- 2 = Moderate inflammation, redness, edema, glazing, bleeding on probing/pressure
- 3 = Severe inflammation, marked redness and edema, ulceration, bleeding on probing and pressure

The assessment of oral mucosa inflammation intensity was performed by a clinical examination and graded by degrees ranging from 1 to 3 (16):

- 1 = slight visible inflammation; a localized change of oral mucosa shown by light red colour, and extending less than 1 cm in diameter.
- 2 = mild intensity of inflammation, shown by moderately red colour of oral mucosa and extending up to 2 cm in diameter.

Statistička analiza obavljena je primjenom χ^2 testa i Fisherovim testom. Vrijednost $p \leq 0,05$ uzeta je kao statistički značajna povezanost ispitivanih varijabli.

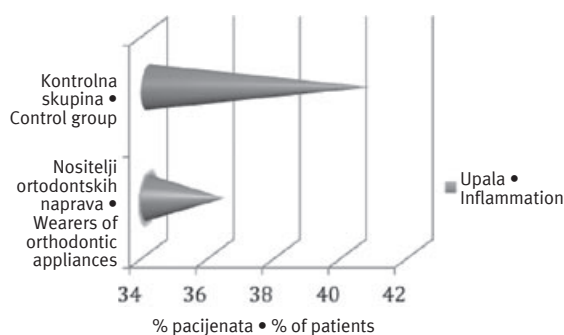
Rezultati

Upala sluznice bila je statistički znatno češća kod ispitanika u kontrolnoj skupini u odnosu prema ispitnoj ($\chi^2=8,99$, $Df=3$, $p=0,029$) (Slika 1.). S obzirom na topografski nalaz, upala je kod većine bila na gingivi i to u području marginalne gingive vestibularno (topografska oznaka prema WHO 31), a rjeđa u području gingive s oralne strane (topografska oznaka 18).

Više sudionika iz ispitne i kontrolne skupine imali su podjednako dobru higijenu usne šupljine ($p=0,5029$, $p>0,05$) (Slika 2.), a tek manji broj nositelja ortodontskih naprava lošiju, no neovisno o vrsti i duljini nošenja naprave.

Rezultati usporedbe upale i oralne higijene pokazali su da su učestalost i intezitet upale bili obrnuto proporcionalni stupnju oralne higijene. Upala je bila najizraženija na marginalnoj gingivi (topografska oznaka 31) te u području tvrdog nepca (topografska oznaka 51,52). Fisherovim testom dokazane su statistički značajne razlike između stupnja oralne higijene i inteziteta upale ($p=2,287E-10$; $p<0,05$). (Slika 3.)

S obzirom na spol i dob ispitanika, upala je bila češća i jača kod dječaka u odnosu prema djevočicama ($p=0,0919$, a to znači $p>0,05$), te u mlađoj



Slika 1. Upala oralne sluznice kod nositelja ortodontskih naprava i u kontrolnoj skupini

Figure 1 Inflammation of oral mucosa in orthodontic patients and controls

- 3 = severe inflammation shown by intensively red colour, spreading over oral mucosa more than 2 cm in diameter.

Statistic analysis was carried out by the use of χ^2 and Fisher's exact test. Value $p \leq 0.05$ was taken as a statistically significant correlation between the examined variables.

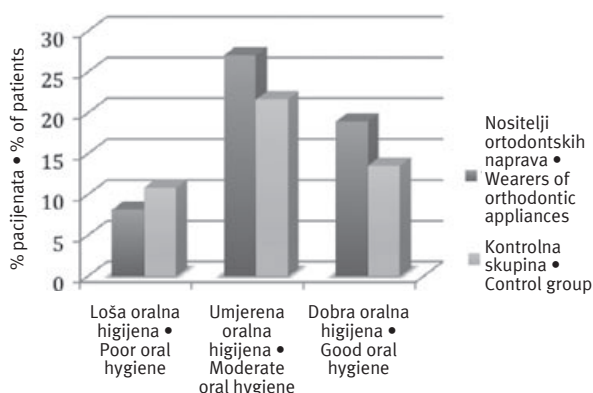
Results

Inflammation of oral mucosa was statistically more significant and common in controls compared to the orthodontic appliance wearers group ($\chi^2=8.99$, $Df=3$, $p=0.029$) (Figure 1). With regard to topographic findings, in the largest number of subjects the inflammation was present on vestibular part of marginal gingiva (WHO topographic scheme 31), whereas it was less common found on lower vestibular mucosa (WHO topographic scheme 18).

More of subjects from both groups had equally good oral hygiene ($p=0.5029$, $p>0.05$) (Figure 2). Only a smaller number of orthodontic patients have poor oral hygiene but not in correlation with the type of orthodontic appliance.

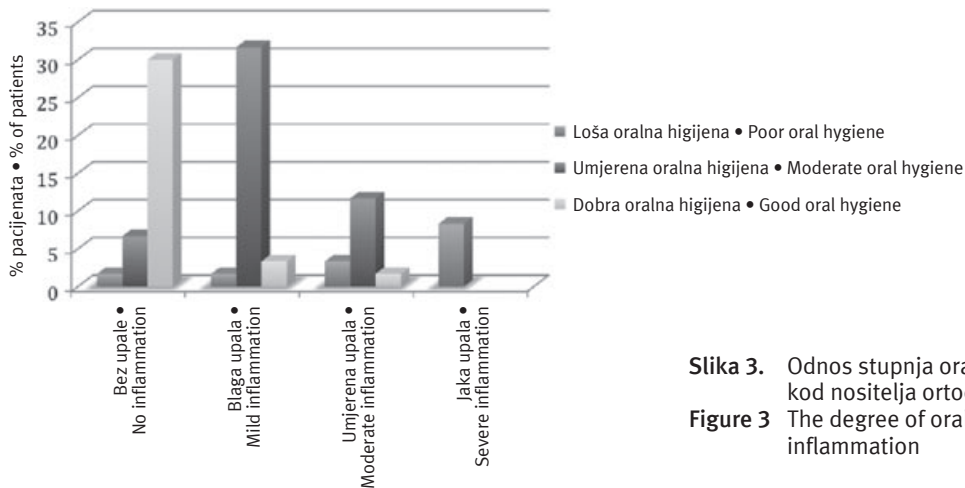
Results of comparison between oral mucosa inflammation and oral hygiene revealed that frequency and intensity of inflammation was reversely proportional to the degree of oral hygiene. The inflammation was most pronounced along the marginal gingiva (WHO topographic scheme 31) and on the hard palate (WHO topographic scheme 51, 52). Statistically significant differences between the degree of oral hygiene and intensity of inflammation were proved by Fisher's exact test ($p=2,287E-10$; $p<0.05$) (Figure 3).

Regarding sex and age, the inflammation was more frequent and greater in boys compared to girls

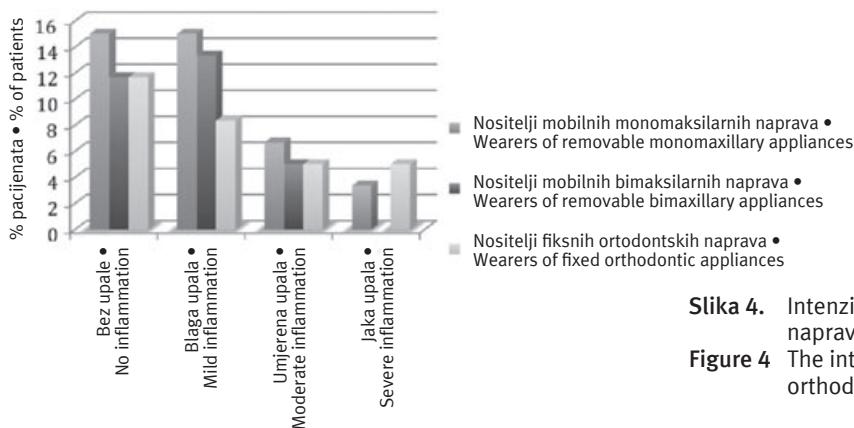


Slika 2. Stupanj oralne higijene nositelja ortodontskih naprava i u kontrolnoj skupini

Figure 2 Oral cavity hygiene in orthodontic patients and controls



Slika 3. Odnos stupnja oralne higijene i intenziteta upale kod nositelja ortodontskih naprava
Figure 3 The degree of oral hygiene and intensity of inflammation



Slika 4. Intenzitet upale u odnosu prema vrsti ortodontske naprave
Figure 4 The intensity of inflammation and the type of orthodontic appliance

skupini ispitanika ($\chi^2= 6,1936$, $Df= 3$, $p= 0,026$; $p>0,05$), ali bez statistički znatnih razlika.

Procjena upale sluznice kod nositelja ortodontskih naprava pokazala je da manji broj ispitanika (40%) nije imao upalne promjene na sluznici, a većina - 60% imala je slabiju upalu bez statistički velikih razlika s obzirom na vrstu naprave. Upala jačeg intenziteta bila je zapažena kod nositelja fiksni ortodontskih naprava i to uglavnom u području marginalne gingive vestibularno (Fisherov test $p=0,769$; $p>0,05$).

Rasprava

Ortodontske naprave nužno uspostavljaju nove odnose u usnoj šupljini i tome se moraju prilagoditi sva tkiva. Tako promjene na sluznici kod nositelja ortodontskih naprava mogu biti prouzročene napravom ili nedovoljnom brigom o higijeni usne šupljine i ortodontske naprave (10).

($p=0.0919$, $p>0.05$), as well as in younger subjects ($\chi^2=6.1936$, $Df=3$, $p=0.0126$; $p>0.05$) but without statistically significance.

Assessment of inflammation in orthodontic patients revealed that 40% of subjects did not have any inflammatory changes of oral mucosa (Figure 4). The remaining 60% of subjects had inflammation, most of them of lower intensity, without statistically significant differences regarding to the type of orthodontic appliance. Greater inflammation was observed in wearers of fixed orthodontic patients, mainly on the margin of vestibular gingiva (Fisher's test $p=0.769$; $p>0.05$).

Discussion

Orthodontic appliances inevitably cause new relationships within the oral cavity to which all dental tissues must adapt. Changes occurring on oral mucosa in orthodontic patients can be caused either by the very appliance or by inadequate hygiene of the oral cavity and appliance (10).

Promjene na sluznici mogu nastati i zbog samozljeđivanja, oralnih parafunkcija ili neuroloških bolesti. U takvim se slučajevima ortodonska naprava izrađuje zato da bi se sluznica zaštitila od daljnog ozljeđivanja (17).

Rezultati ovog istraživanja pokazali su da je upala sluznice bila najčešći patološki nalaz u objema skupinama ispitanika, ali češća kod onih bez ortodontskih naprava. Upalne promjene na sluznici imalo je više ispitanika u kontrolnoj negoli u ispitnoj skupini.

Kwam i suradnici također su potvrdili da su upalna oštećenja sluznice puno češća u odnosu prema ulceracijama – one se pojavljuju povremeno i uglavnom su povezane s nošenjem fiksnih ortodontskih naprava (7). Prema drugim izvješćima, upala sluznice usne šupljine može nastati i zbog preosjetljivosti na ione nikla i bakra u stomatološkoj leguri (11), ili njihovim otpuštanjem u slinu. Posljedica je toksična reakcija sluznice (18). Upalu sluznice usne šupljine mogu potaknuti i frikcijske mikrotraume između tijela naprave i oralne sluznice (18, 19) ili neodgovarajuća i nedovoljna oralna higijena (20-22) te higijene naprave koju se zbog izrade ili hrapave površine ne može pravilno očistiti, pa mehanički iritira sluznicu (9, 23).

U ovom istraživanju upala se najčešće javljala u području marginalne gingive. Taj je nalaz u skladu s podacima Rafea i suradnika – oni su dokazali da se plak kod ortodontskih pacijenata uglavnom akumulira na bravicama duž marginalne gingive (24). To je istodobno i mjesto povezivanja kompozitne smole sa caklinom zuba i na tom je području kompozit skvrčen radi polimerizacije zbog različitog koeficijenta toplinske ekspanzije. Rezultat je rubno lokaliziran, nepravilan i hrapav rascjep koji pogoduje akumulaciji bakterija što uzrokuje upalu toga područja (24).

Među našim ispitanicima nositelji ortodontskih naprava imali su bolju oralnu higijenu, premda ne statistički znatnu. Razlog je dodatna poduka ortodontskih pacijenata tijekom liječenja o tome kako pravilno obavljati oralnu higijenu. Taj rezultat potkrepljuju podaci Øgaarda i njegovih kolega koji su uočili manje bijelih točkastih lezija na caklini zuba, te manje plaka i gingivitisa kod ortodontskih pacijenata negoli kod onih liječenih kod općeg stomatologa (21).

Naši rezultati pokazuju jaču upalu gingive kod osoba sa slabijom oralnom higijenom, što je u skladu s ranijim istraživanjima (20,21,25). Neki autori smatraju da je oralna higijena jedan od važnih čim-

Changes on oral mucosa can occur as a result of self-inflicted injuries or some systemic diseases where the orthodontic appliance plays a role in protection of mucosa from further injuries (17).

The results of this study revealed that mucosal inflammation was the most common pathological finding in both groups. Inflammation was, however, more frequent in the control group.

Kwam *et al.* also studied the effect of orthodontic appliances on oral mucosa and found that inflammatory mucosal lesions were more common than ulcerations, which occur sporadically and are most commonly related to fixed orthodontic appliances (7). Mucosal inflammation can also occur for many different causes such as hypersensitivity reaction caused by nickel and copper ions in dental alloys (11), or by their release into saliva, which consequently leads to a toxic reaction of the mucosa (18). Additional causes include friction microtrauma between the appliance and oral mucosa (18, 19), inadequate or insufficient oral hygiene (20-22) and the hygiene of the appliance, which does not allow adequate cleaning, due to irregular fabrication, or coarse surface or it mechanically irritates the mucosa (9,23).

It has been observed that inflammation most commonly occurred in the area of marginal gingiva. This finding complies with published data by Rafe *et al.* who proved that plaque in orthodontic patients is mainly accumulated on brackets along the marginal gingiva (24). At the same time, this is the contact point between composite resin and tooth enamel where the composite shrinks due to curing because of different coefficient of thermal expansion. As a result, a marginally localized fissure appears which is irregular and coarse, thus favoring bacterial accumulation, which causes the inflammation of this area (24).

The wearers of orthodontic appliances who participated in this study had better oral hygiene than non-wearers, although this was not statistically significant. The reason for this was an increased need for oral hygiene measures during orthodontic treatment as well as the additional education of orthodontic patients in adequate oral hygiene. The results of this study correspond to the data by Øgaard *et al.* who observed a smaller number of white spot lesions on the tooth enamel, less plaque and gingivitis in orthodontic patients compared to patients treated by general dental practitioner (21).

Furthermore, the results of this study reveal more intensive inflammation in subjects with poor oral

benika u određivanju trajanja ortodontskog liječenja. Kod ispitanika s lošijom oralnom higijenom liječenje je u prosjeku bilo dulje (26, 27).

Rezultati usporedbe intenziteta upale i spola pokazali su da je upala češća kod dječaka u odnosu prema djevojčicama, premda ne statistički znatno.

Slične podatke navodi i Skidmore koji tvrdi da je liječenje dječaka trajalo u prosjeku mjesec dana dulje (28). U istraživanju Scheurera i suradnika djevojčice su se više žalile na bol i tegobe koje im je čini naprava u svakodnevnim aktivnostima (29).

S obzirom na dob, upala sluznice bila je češća u mlađoj dobi premda ne statistički znatno, što se može povezati i s navikama održavanja oralne higijene.

Veći broj ispitanika nije imao upalu sluznice ili je ona bila slabija, a manje nositelja fiksnih ortodontskih naprava imalo je upalu gingive jačeg stupnja. Taj je podatak u skladu sa sličnim istraživanjima (7-9).

Zaključak

Iz rezultata je moguće zaključiti da nositelji ortodontskih naprava bolje i redovitije održavaju oralnu higijenu, a imaju i manje upalnih promjena na sluznici usne šupljine u odnosu prema kontrolnoj skupini.

Zahvala

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hygiene, which complies with the results of similar studies (20,21,25). Some authors consider oral hygiene one of the important factors for determining the duration of orthodontic treatment. The patients with good oral hygiene were treated for a shorter period of time (26). On average, the treatment lasted longer in subjects with poorer oral hygiene (27).

The results of comparison between the intensity of inflammation and sex revealed that inflammation was more common in boys compared to girls although the difference was not statistically significant.

Similar results were reported by Skidmore, who found out that treatment lasted a month longer in boys (28). According to the study by Scheurer *et al.* girls complained more on pain and discomfort caused by the appliance during their everyday activities (29).

Regarding age, the inflammation was more common in subjects of younger age although it was not statistically significant, which can be related to oral hygiene habits and maintenance.

The majority of patients have not experienced oral mucosa inflammation, or had but its lower intensity, while higher intensity inflammation was observed in small number of fixed orthodontic appliance in group. These findings match with the results of other authors (7-9).

Conclusion

Subjects with orthodontic appliances are more aware of the need to maintain good oral hygiene regularly, which results in less frequent inflammatory changes than controls.

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Abstract

Objective: The aim of this study was to examine the impact of oral hygiene and the type of orthodontic appliance on oral mucosa in orthodontic patients. **Methods:** The study included 110 children, aged between 6-18 years (60 subjects were wearers of fixed and removable orthodontic appliances and 50 subjects were control group who had just been referred to orthodontic treatment). A degree of oral hygiene, dental status, and periodontal status as well as the intensity of inflammation of oral mucosa was recorded in all subjects by using verified clinical tests. **Results:** The frequency and intensity of inflammation were reversely proportional to oral hygiene degree ($p < 0.05$). The controls had poorer oral hygiene findings. Only a small number of fixed orthodontic appliance wearers had inflammatory changes of higher intensity (5%). A significant correlation between oral mucosa inflammation and type of orthodontic appliance was not found. **Conclusion:** Orthodontic appliance wearers had better oral hygiene and less frequent inflammatory changes than controls.

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Key words

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