KLINIČKA STUDIJA
CLINICAL ARTICLE

VARIJACIJE POLOŽAJA MAKSILARNIH INCIZIVA KOD MALOKLUZIJA II KLASE 2 ODELJENJA

VARIATIONS OF POSITION OF MAXILLARY INCISORS WITH MALOCCLUSIONS OF II CLASS OF 2ND DEPARTMENT

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Kratak sadržaj

Malokluzija II klasa 2 odeljenje (strm zagrižaj, preklopni zagrižaj, degbis) predstavlja dento-alveolo-gnato-facijalnu anomaliju čija je glavna kakteristika, pored distalnog odnosa vilica, retroinklinacija maksilarnih frontalnih zuba.
Cilj ispitivanja bio je da se odrede varijacije položaja maksilarnih frontalnih zuba osoba sa malokluzijom II klase 2 odeljenja. Materijal i metod. Ispitano je ukupno 1115 ortodontskih pacijenata sa različitim malokluzijama od kojih je 287 bilo sa malokluzijom II-2 (117 muških i 170 ženskih osoba). Različiti položaji maksilarnih frontalnih zuba razvrstani su u 7 oblika po Meškovu. Rezultati. Kod naših ispitanika dominira prvi oblik položaja maksilarnih frontalnih zuba (retruzija oba centralna sekutića i protruzija oba lateralna sekutića) u 51,2%, sledeći po zastupljenosti je drugi oblik (retruzija sva četiri sekutića) u 23%, sledi peti oblik (retruzija oba centralna i jednog lateralnog sekutića) u 14,3%, dok su ostali oblici položaja zastupljeni u nižem procentu.

Ključne reči: *malokluzija II -1, incizivi*

Abstract

Malocclusion II class 2nd department (steep bite, lapped bite, degbis) represents dento-alveolo-gnatho-facial anomaly whose main characteristic, beside distal relation of jaws, is retroinclination of maxillary frontal teeth. The objective of exploring was to determine variations of the position of maxillary frontal teeth with persons with malocclusion II class 2nd department. Material and method. There were explored totally 1115 orthodontic patients with various malocclusions out of which 287 were with malocclusion II-2 (117 male and 170 female persons). Different positions of maxillary frontal teeth have been sorted out into 7 shapes according to Meskov. Results. With our examinees there is dominant the first shape of the position of maxillary frontal teeth (retrusion of both central bicuspids and protrusion of both lateral bicuspids) in 51.2%, next is, as per representations, the second shape (retrusion of all the four bicuspids) in 23%, there follows the fifth shape (retrusion of both central and one lateral bicuspid) in 14.3% while the other shapes of the position are represented in a lower percentage.

Key words: *malocclusion II-1, incisorsIntroduction*

Uvod

Malokluzija II klasa 2 odeljenje (strm zagrižaj, preklopni zagrižaj, degbis) predstavlja dento-alveolo-gnato-facijalnu anomaliju čija je glavna karakteristika, pored distalnog odnosa vilica, retroinklinacija maksilarnih frontalnih zuba.

Introduction

Malocclusion of II class of 2nd department (steep bite, overlapping bite, degbis) represents dento-alveolo-gnatho-facial anomaly having the main characteristic, beside distal relationship between the jaws, the retroinclination of maxillary frontal teeth.

Malokluzija II-2 može se pojaviti u mlečnoj denticiji i preko mešovite preneti na stalnu denticiju. Osnovne karakteristike degbisa su distalni odnos zuba i vilica (za polovinu ili punu širinu premolara), jako izražena Špeova kriva (posebno donjeg zubnog niza), duboki zagrižaj izraženog stepena, dobro razvijena apikalna baza naročito gornja, retruzija gornjih frontalnih zuba.

Kod osoba sa ovom malokluzijom postoji osoben izgled lica koji karakteriše smanjena donja trećina lica, jače isturen nos, isturena i na gore povijena brada te se ima utisak tendencije spajanja nosa i brade. Naglašen je sulcus mentolabialis, oralna fisura je visoko postavljena preko labijalnih površina gornjih sekutića što se manifestuje kao "gummi smile" pri govoru i smehu (vidljiv veći deo gingive i apikalne baze)[1] (slika 1).

Malocclusion of II-2 can appear in milk dentition and through the mixed one can be shifted to the permanent dentition. The basic characteristics of degbis are distal relationship between teeth and jaws (for a half and full width of premolars), strongly expressed Speo curve (especially of lower dental string), deep bite of expressed degree, well developed apical base, in particular the upper one, retrusion of upper frontal teeth.

With persons with this malocclusion there are peculiar looks of the face which is characterized by reduced lower third of the face, more strongly protruded nose, protruded and upwards bent chin thereby creating an impression of the tendency of connecting nose and chin. Sulcus mentolabialis is expressed, oral fissure is highly set over labial surfaces of upper incisors which is manifested as “gummy smile” while speaking and laughing (visible bigger part of gingiva and apical base)[1] (figure 1).

Slika 1. Izgled pacijenta sa malokluzijom II 2

Figure 1. The looks os patient with malocclusion II division 2

Maksilarni zubni niz može biti uzan kao posledica oralnog nagiba bočnih zuba dok se u mandibularnom zubnom nizu sreće jako izražena Špeova kriva (slika 2).

Maxillary dental arch may be crowded as a result of oral inclination of posterior upper teeth while mandibular dental arch shows very expressed Speo curve (figure 2).

Slika 2. Intraoralni nalaz

Figure 2. Intraoral finding

Iako je glavna karakteristika malokluzije II klase 2 odeljenja retruzija maksilarnih frontalnih zuba, činjenica je da vrlo često nisu svi ovi zubi retroinklinirani već u položaju ovih zuba mogu postojati određene varijacije.

Although the main characteristic of malocclusion of II class of 2nd department of retrusion of maxillary frontal teeth, the fact is that very often not all of these teeth are retroinclined but in the position of these teeth there may exist certain variations.

Po pitanju etiologije malokluzije II klase 2 odeljenja postoje podeljena mišljenja, s tim da nekoliko autora smatra da je uticaj mekih tkiva i spoljašnjih faktora od bitne važnosti na formiranje ove nepravilnosti,[2-5] a u literaturi preovladava stav većine autora, da se radi o naslednom poremećaju.[6-11]

Naša ranija ispitivanja familija pokazala su prisustvo anomalije u četiri uzastopne generacije jedne familije, što sugeriše autozomno dominantni način nasleđivanja.[12]

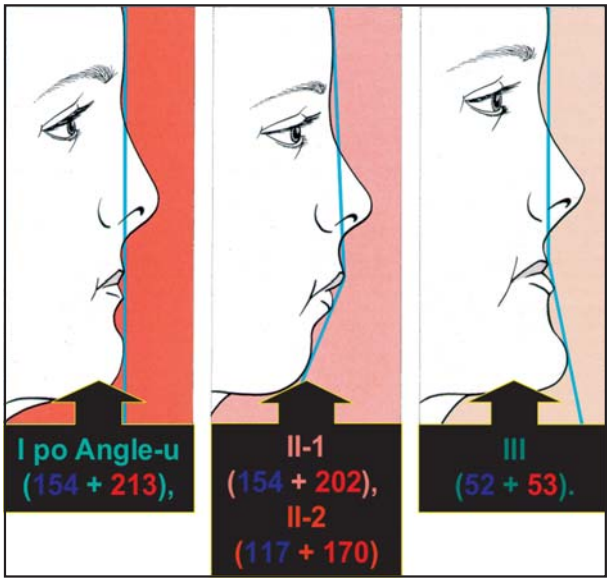
Cilj ispitivanja

Cilj našeg istraživanja bio je da se odrede varijacije položaja maksilarnih frontalnih zuba kod osoba sa malokluzijom II klase 2 odeljenja.

Materijal i metod

Ispitivanje je obavljeno na Klinici za stomatologiju u Nišu, odeljenje za ortodonciju, na studijskim modelima pacijenata koji su ortodontski tretirani. Ukupno je pregledano 1115 studijskih modela, od toga 477 pacijenata muškog i 638 pacijenata ženskog pola.

Od ukupnog broja ispitanika 367 osoba (32,9%) bilo je sa malokluzijom I klase po Angleu (154 muškog i 213 ženskog pola), 356 osoba (31,9%) sa malokluzijom II-1 (154 muškog i 202 ženskog pola), 287 (25,70%) sa malokluzijom II-2 (117 muškog i 170 ženskog pola) i 105 (9,4%) osoba sa malokluzijom III klase (52 muškog i 53 ženskog pola) (šema 1).



Šema 1. Broj ispitanih osoba prema sa različitim malokluzijama

As concerns etiology of malocclusion of II class of 2nd department there are separate standpoints provided that a few authors are of the opinion that the influence of soft tissues and external factors are of essential importance on forming this irregularity,[2-5] and there prevails in literature the standpoint of majority of authors, that hereditary disorder is in question.[6-11]

Our former investigations of families and relatives showed presence of anomaly in four subsequent generations of one family with relatives which suggests autosomous dominant way of inheriting.[12]

Aim of investigation

The aim of our research was to determine variations of position of maxillary frontal teeth with persons with malocclusion of II class of 2nd department.

Material and method

Research was performed at Clinic of Stomatology in Nis, department for orthodontia, on study models of patients who were orthodontically treated. There were totally examined 1,115 study models, out of which 477 patients of male and 638 of patients of female sex.

Out of entire amount of examinees, 367 persons (32.9%) were with malocclusion of I class as per Angle (154 male and 213 female sex), 356 persons (31.9%) with malocclusion II-I (154 of male and 202 of female sex), 287 (25.70%) with malocclusion II-2 (117 of male and 170 of female sex) and 105 (9.4%) of persons with malocclusion of III class (52 of male and 53 of female sex) (scheme 1).

Scheme 1. Amount of examined persons according to various malocclusions

Kako je cilj rada bio odrediti položaj gornjih frontalnih zuba kod osoba sa degbisom, primenili smo metodu autora Meškova,[12] koji je razvrstao moguće kombinacije položaja gornjih frontalnih zuba u 7 oblika:

1. oblik – retruzija oba centralna i protruzija oba lateralna inciziva;

2. oblik – retruzija sva četri inciziva;

3. oblik – retruzija sva četri inciziva i oba očnjaka

4. oblik – retruzija jednog centralnog i jednog lateralnog inciziva sa jedene strane zubnog niza

5. oblik – retruzija oba centralna i jednog lateralnog inciziva

6. oblik – retruzija oba centralna, jednog lateralnog inciziva i očnjaka sa jedne strane zubnog niza

7. oblik – retruzija oba centralna, oba lateralna inciziva i jednog očnjaka (šema 2).

As the aim of the paperwork was to determine position of upper frontal teeth with persons with degbis, we applied the method of author Meskov[12], who sorted out posible combinatons of position of upper frontal teeth in 7 shapes:

1. shape – retrusion of both central and protrusion of both lateral incisors;

2. shape – retrusion of all four incisors;

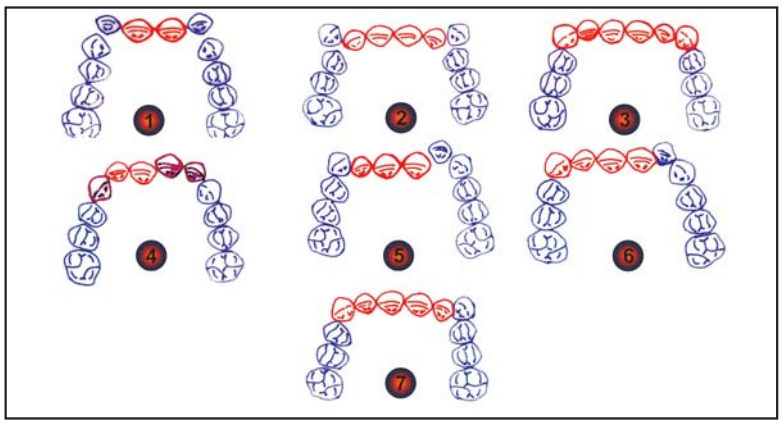
3. shape – retrusion of all four incisors and both bicuspids;

4. shape – retrusion of one central and one lateral incisor from one side of dental string

5. shape – retrusion of both central and one lateral incisor;

6. shape – retrusion of both central, one lateral incisor and bicuspid from one side of dental string;

7. shape – retrusion of both central, both lateral incisors and one bicuspid (scheme 2).



Šema 2. Različiti oblici položaja gornjih frontalnih zuba

Scheme 2. Shapes of position of upper frontal teeth

Rezultati

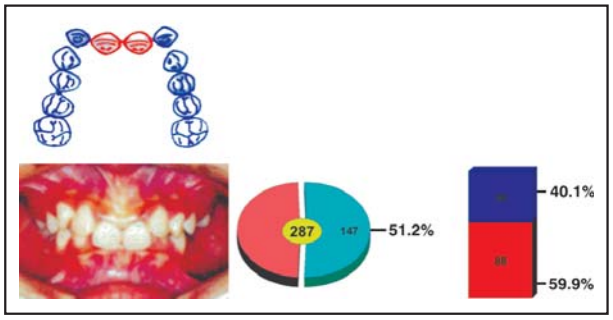
U našem ispitivanom uzorku od ukupno 287 studijskih modela osoba sa malokluzijom II 2 odeljenja kod 147 osoba (51,2%) zastupljen je prvi oblik položaja gornjih frontalnih zuba (retruzija oba centralna i protruzija oba lateralna sekutića). Ovaj vid položaja bio je zastupljen kod 88 osoba ženskog pola i 59 osoba muškog pola (šema 3).

Sledeći po zastupljenosti u našem uzorku bio je drugi oblik položaja (retruzija sva četiri inciziva). Ovaj oblik nađen je kod ukupno 66 osoba (23%), od toga 45 osoba ženskog i 21 osoba muškog pola (šema 4).

Results

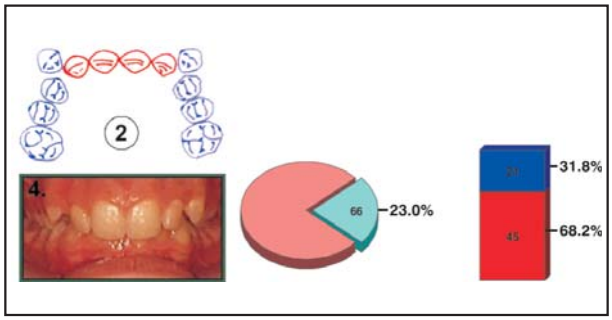
In our examined sample, out of totally 287 study models of persons with malocclusion of II 2 department, with 147 persons (51.2%), there is represented the first shape of position of upper frontal teeth (retrusion of both central and protrusion of both lateral incisors). This form of position was presented wih 88 persons of female sex and 59 persons of male sex (scheme 3).

The next one, according to occurrence, in our sample there was another shape of position (retrusion of all four incisors). This shape was found with totally 66 persons (23%), out of which 45 persons of female and 21 persons of male sex (scheme 4).



Šema 3. Prvi oblik položaja gornjih frontalnih zuba

Scheme 3. The first shape of position of upper frontal teeth



Šema 4. Drugi oblik

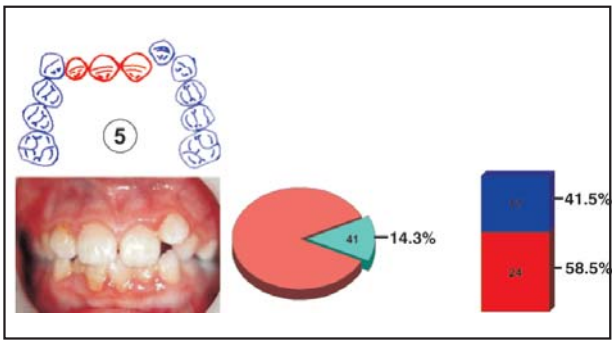
Scheme 4. The second shape

Peti oblik položaja frontalnih zuba (retruzija oba centralna i jednog lateralnog sekutića) našli smo kod 41 ispitane osobe (14,28%) i to 17 osoba muškog i 24 osobe ženskog pola (šema 5).

Treći oblik položaja frontalnih maksilarnih zuba imalo je ukupno 14 osoba (4,87%), od toga 9 osoba muškog i 5 osoba ženskog pola (šema 6).

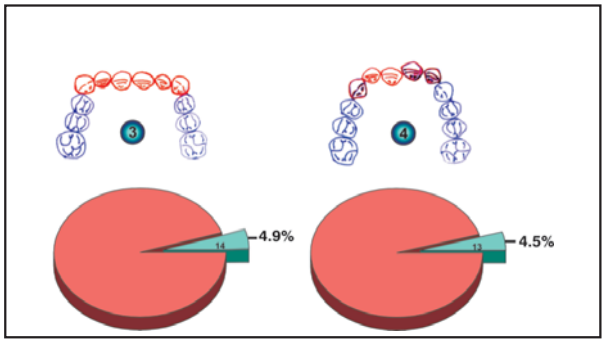
The fifth shape of position of frontal teeth (retrusion of both central and one lateral incisor) we found with 41 examined persons (14.28%) and that is 17 persons of male and 24 persons of female sex (scheme 5).

The third shape of position of frontal maxillary teeth was possessed by totally 14 persons (4.87%), out of which 9 persons of male and 5 persons of female sex (scheme 6).



Šema 5. Peti oblik

Scheme 5. The fifth shape



Šema 6. Treći i četvrti oblik

Scheme 6. The third and fourth shape

Četvrti oblik položaja frontalnih zuba u našem uzorku zastupljen je u približno istom procentu kao i treći oblik, ukupno 13 osoba (4,52%), od toga 7 osoba muškog i 6 osoba ženskog pola (šema 6).

Šesti i sedmi oblik položaja frontalnih zuba pokazuju mali procenat zastupljenosti tako da je šesti oblik prisutan kod 4 osobe (2 muškog i 2 ženskog pola), dok je sedmi oblik konstatovan kod samo 2 osobe i to obe ženskog pola (šema 7).

The fourth shape of position of frontal teeth in our sample is presented in an approximately same percentage and the third shape, totally 13 persons (4.52%), out of which 7 persons of male and 6 persons of female sex (scheme 6).

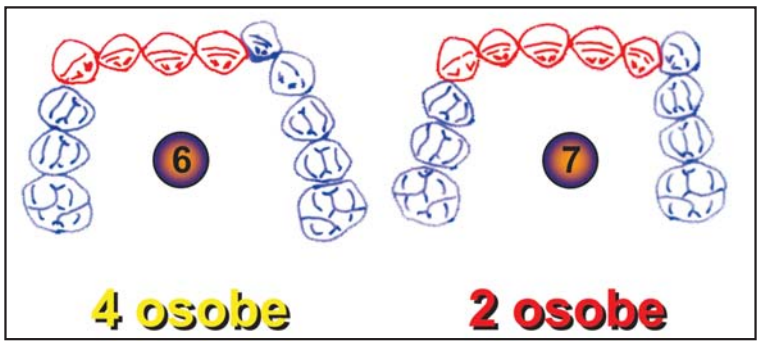
The sixth and seventh shapes of position of frontal teeth show small percentage of occurrence so that the sixth shape is present with 4 persons (2 of male and 2 of female sex) which makes little %, while the seventh shape was recorded with only 2 persons being both of female sex (scheme 7).

Diskusija

Varijacije položaja maksilarnih frontalnih zuba kod osoba muškog pola (kružni dijagram 1) pokazuju da je u najvećem procentu za-

Discussion

Variations of position of maxillary frontal teeth with persons of male sex (circular diagram



Šema 7. Šesti i sedmi oblik

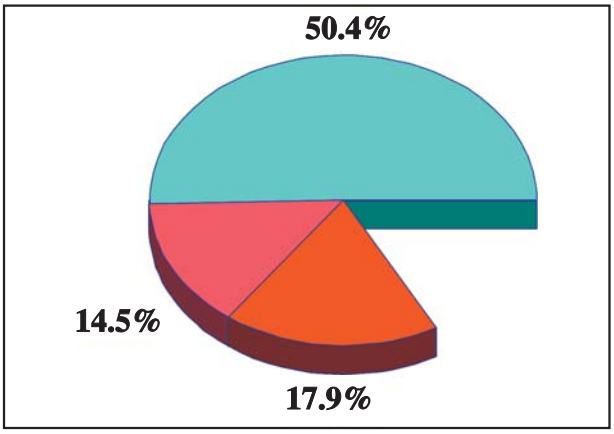
Scheme 7. The sixth and the seventh shape

stupljena retruzija oba centralna sekutića uz protruziju lateralnih (50,42%), retruzija svih maksilarnih sekutića (17,94%), dok je retruzija oba centralna i protruzija jednog od lateralnih sekutića zastupljena u 14,52%, dok su ostali vidovi položaja zastupljeni u manjem procentu (kružni dijagram 1).

Varijacije položaja maksilarnih frontalnih zuba kod osoba ženskog pola (kružni dijagram 2) pokazuju najčešću zastupljenost retruzije centralnih i protruzije lateralnih sekutića 52,21%. Retruzija sva četiri sekutića zastupljena je u 26,47 % dok je retruzija centralnih i protruzija jednog od lateralnih sekutića prisutna u 14,12 % (kružni dijagram 2).

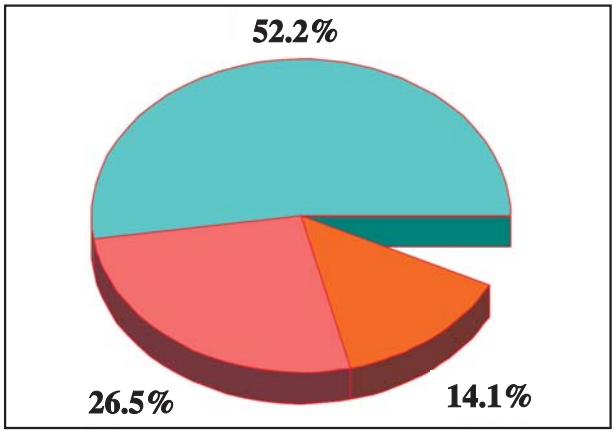
1) show that, in the biggest percentage, there is presented retrusion of both central incisors along with protrusion of lateral (50.42%), retrusion of all maxilllary incisors (17.94%), while retrusion of both central and protrusion of one of lateral incisors is presented in 14.52%, while the other forms of position are presented in a smaller percentage (circular diagram 1).

Variations of position of maxillary frontal teeth with persons of female sex (circular diagram 2) show most frequent occurrence of retrusion of central and protrusion of lateral incisors 52.21%. Retrusion of all four incisors is presented in 26.47% while retrusion of central ones and protrusion of one of lateral incisors is present with 14.12% (circular diagram 2).



Kružni dijagram 1. Varijacije položaja maksilarnih frontalnih zuba kod osoba muškog pola

Circular diagram 1. Variations of position of maxillary frontal teeth with persons of male sex



Kružni dijagram 2. Varijacije položaja maksilarnih frontalnih zuba kod osoba ženskog pola

Circular diagram 2. Variations of position of maxillary frontal teeth with persons of female sex

Rezultati dobijeni našim istraživanjem poklapaju se sa rezultatima Meškova [12] koji je svoje ispitivanje sproveo na makedonskom stanovništvu, da kod osoba sa malokluzijom II klase 2 odeljenja dominira prvi oblik položaja maksilarnih frontalnih zuba (retruzija oba centralna i protruzija oba lateralna sekutića), što

The results obtained by our research work coincide with the results by Meskov [12] who performed his examination on the Macedonian population that, with persons with malocclusion of II class of 2nd department, there dominates the first shape of position of maxillary frontal teeth (retrusion of both central and protrusion of both lateral incisors), which represents a classical

predstavlja klasični oblik degbisa opisan u literaturi, iako je procenat zastupljenosti u našem istraživanju bio nešto veći (51,2%) u odnosu na prethodno istraživanje (33,6%). Odstupanja postoje samo po pitanju najređe kombinacije položaja gornjih frontalnih zuba, s obzirom da naši rezultati pokazuju da je kod naših ispitanika to sedmi oblik položaja, koji je zastupljen sa 0,70 % dok je kod Meškova to četvrti oblik položaja sa 2,70%.

Zaključak

Na osnovu izvršenog ispitivanja mogu se izvesti sledeći rezultati:

1. Kod osoba oba pola sa malokluzijom II klase 2 odeljenje dominira prvi oblik položaja ovih zuba, odnosno retruzija centralnih i protruzija lateralnih inciziva, jer je ovaj oblik zastupljen u nešto više od polovine ispitivanih osoba (51,2%);

2. Drugi oblik položaja gornjih frontalnih zuba, tj. retruzija sva četiri inciziva, zastupljen je sa 23,00 % u ukupnom uzorku;

3. Peti oblik položaja frontalnih zuba odnosno kombinacija retruzije oba centralna i jednog lateralnog inciziva, zastupljen je u 14,28%;

4. Sve ostale varijacije inklinacija maksilarnih inciziva i očnjaka sreću se kod manjeg broja ispitanika pri čemu je retruzija oba centralna, oba lateralna sekutića i jednog očnjaka izuzetno retka kombinacija koju smo konstatovali u svega 0,7% ispitanika.

Poznavanje kombinacija položaja gornjih frontalnih zuba kod malokluzije II klase 2 odeljenje je od važnosti za planiranje ortodontske terapije i postizanje zadovoljavajućih funkcionalnih i estetskih rezultata.

shape of degbis described in literature although the percentage of occurrence in our research work was slightly bigger (51.2%) in relation to the previous research (33.6%). Divergences exist only as concerns the most rare combinations of position of upper frontal teeth considering the fact that our results show that it is the seventh shape of position with our examinees, which is presented with 0.70% while with Meskov it is the fourth shape of position with 2.70%.

Conclusion

Based on the executed research work, there can be concluded the following results:

1. With persons of both sexes with malocclusion of II class of 2nd department, there dominates the first shape of position of these teeth that is retrusion of central and protrusion of lateral incisors; because this shape is presented with slightly more than half of the examined persons (51.2%);

2. The second shape of position of upper frontal teeth i.e. retrusion of all four incisors is presented with 23.00% in the total sample;

3. The fifth shape of position of frontal teeth that is combination of retrusion of both central and one lateral incisor is presented in 14.28%;

4. All other variations of inclinations of maxillary incisors and bicuspids are met with a smaller amount of examinees whereby retrusion of both central, both lateral incisors and one bicuspid is extremely rare combination which we recorded in only 0.7% examinees.

The knowledge of combinations of position of upper frontal teeth with malocclusion of II class of 2nd department is of importance for planning orthodontic therapy and achievement of satisfactory functional and aesthetic results.

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PRELIMINARNA STUDIJA
PRELIMINAR STUDY

SEM IZGLED NAGRIŽENIH BUKALNIH POVRŠINA GLEĐI ZUBA ORTOFOSFORNOM KISELINOM U RAZLIČITOM VREMENSKOM TRAJANJU

SEM LOOK OF THE DAMAGED BUCCAL SURFACES OF THE TEETH ENAMEL WITH ORTHO PHOSPHORIC ACID IN DIFFERENT TIME DURATIONS

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Kratak sadržaj

Na 20 zubnih uzoraka (premolara) izvađenih iz ortodontskih razloga, izvršeno je kondicioniranje gleđi 37% fosfornom kiselinom u trajanju od 15, 30 i 45 sekundi. Materijal je potom podvrgnut standardnoj tehnici obrade i pripremljen za ultrastrukturno ispitivanje na SEM aparatu (JEOL-JSM-5300). Dobijeni rezultati pokazuju različit mikroreljef gleđnih površina u zavisnosti od dužine eksponiranja kiseline. Na osnovu dobijenih rezultata, razlikuju se različiti modeli nagrizanja gleđi koji mogu imati dva tipa demineralizacije, a na osnovu izgleda gleđnih prizmi može se sugerirati optimalno vreme kondicioniranja same gleđi.

Ključne reči: *gleđ, bravice, adhezivi*

Summary

On 20 teeth samples (premolars), extracted for orthodontic reasons, the enamel conditioning with 37% phosphorus acid was done, lasting 15, 30, 45 seconds. The material undergone the standard procession technique and was prepared for ultra structural examining on SEM device (JEOL-JSM-5300). Given results show different micro relief of enamel surfaces, depending on the length of being exposed to the acid. Given results make distinction among different models of enamel damaging which can have two types of demineralization, and on the basis of the enamel prisms, we can suggest the optimum time for enamel conditioning.

Key words: *enamel, brackets, adhesives*

Uvod

Zubna gleđ predstavlja acelularnu i afibrilarnu strukturu, izgrađenu uglavnom od kristala apatita. Iako ne sadrži ni krvne ni limfne sudove, što joj ograničava mogućnost aktivne odbrane, gleđ se ipak smatra vitalnim tkivom koje uspeva da u određenom vremenskom periodu održi intaktnost svoje površine.[1] Gleđna

Introduction

Teeth enamel represents acelular and afibrilar structure made mostly by apatite crystals. Although it does not contain blood and lymph vessels, thus limiting an active defense, enamel is still considered a vital tissue that manages to keep its surface intact for a certain period of time.[1] Enamel surface with its liquid

površina sa okolnom tečnošću predstavlja jedan dinamičan ekvilibrijum.

Sa nicanjem zuba u oralnu sredinu, gleđ je u principu kompletno mineralizovana. Međutim, površina gleđi, u vreme erupcije, značajno je porozna, i tek u periodu tzv. **"posteruptivne maturacije"** dolazi do kompletne maturacije gleđi. Pojavom zuba u oralnoj sredini, površina gleđi neprestano doživljava modifikacije i dinamičke transformacije. Od tog momenta površina gleđi gotovo nikad nije bez plakovnog sadržaja i mikroorganizama koji čine njihov glavni sastav. U plakama postoji kontinuirana metabolička aktivnost koja dovodi do cikličnih promena pH sredine i čestog smenjivanja procesa izlaska (rastvaranja) minerala, tj. demineralizacije i njihove ugradnje odnosno remineralizacije. Kako gleđ zuba nema mogućnost aktivne odbrane jer ne sadrži ni krvne ni limfne sudove, intaktnost svoje površine održava biološkom ravnotežom procesa demineralizacije i remineralizacije. Metabolički procesi koji se intenzivno odigravaju u mikrobnim masama koje okružuju površinu gleđi, često rezultiraju smanjenjem pH u plakovnom sistemu i dovode do rastvaranja površine gleđi. Najraniji znak ovog rastvaranja humane gleđi može se otkriti skening elektronskim mikroskopom, a površina zuba izgleda "šupljikavo". Raznolikost promena koje se konstantno odvijaju u oralnoj sredini, a naročito u plakovnom sistemu koji je okružuje, bitno utiču na stabilnost površinskih slojeva gleđi zuba.[2]

Postoje dva tipa rastvaranja gleđi: **tip I** nastaje po modelu **subpovršinskih lezija** (white spot lesion, tj. bela mrlja) i **tip II** demineralizacije, nastaje po modelu **erozije** gleđi posle nagrizanja, i može biti po modelu, koji se karakteriše demineralizacijom centara prizama, a takođe razlikujemo i model erozije koji se karakteriše razaranjem gleđnih prizama po periferiji. Postoji i kombinacija ova dva modela, a to je III tip, koji je nepovoljan i ogleda se u potpunom razaranju gleđnih prizama nakon nagrizanja nekom od kiselina. Nagrizanje gleđi rastvorima različitih kiselina je fizičko-hemijski postupak kojim se povećava aktivna površina potrebna za retenciju kompozitnih i adhezivnih materijala. Ova planirana i strogo vođena demineralizacija dovodi do selektivne razgradnje neorganskog dela gleđi u obliku monokalcijumovih monohidratnih soli na mestima koja odgovaraju centru i rubovima kristala prizmatskih struktura.[3]

surrounding represents one dynamic equilibrium.

With teeth coming out into the oral surrounding, enamel is completely mineralized. However, enamel surface is significantly porous in the time of eruption, and the complete enamel maturation happens in the time of **"post eruptive maturation"**. When teeth appear in oral surrounding, enamel surface is constantly going through modifications and dynamic transformations. From that moment on, enamel surface is never without plaque content and microorganisms, which make their main composition. There is a continuing metabolic activity in plaque, which leads to cyclical changes in pH and often changes in processes of demineralization and remineralization. Biological balance between demineralization and remineralization maintain the intactness of enamel. Metabolic processes taking places in microbe masses which surround the enamel surface, often result with lowering of pH in a plaque system and lead to dissolving of enamel surface. Electronic microscopic scanning can discover the earliest sign of this humane enamel dissolving and teeth surface looks porous. Variety of changes constantly happening in oral surrounding and especially in a plaque system that surrounds it, have a great influence on stability of teeth enamel surface layers.[2]

There are two types of enamel dissolving: **type I** happens according to the model of **subsurface lesions** (white spot lesion) and **type II** of demineralization happens according to the enamel **erosion** model after damaging and can happen according to the model characterized by prism centers demineralization, and we also differ erosion model characterized by enamel prism damaging on the periphery. There is also a combination of these two models, type III, which is negative because of a complete destruction of enamel prisms after acid damaging. Enamel damaging by acid dissolutions is a physical and chemical procedure that increases the active surface necessary for retention of composite and adhesive materials. This planned and strictly led demineralization brings to selective razing of non organic enamel part in the shape of monocalcium monohydrate salts at places that suit centers and edges of crystal prismatic structures.[3]

Nasuprot procesu demineralizacije stoji proces remineralizacije, koga karakteriše reparacija kristala hidroksiapatita oštećenih kiselinama ili stvaranjem novih kristala apatita gleđi. Ultrastrukturna slika ovih promena zavisi od koncentracije kiseline, orijentacije kristala u odnosu na površinu zuba, ali u najvećoj meri od vremena delovanja kiseline na gleđ.[4,5]

Sa pojavom bondne tehnike koju je u stomatologiju uveo Buonocore 1955. god., koncept lepljenja različitih materijala za gleđ doživeo je svoju primenu i u ortodonciji, služeći u lepljenju ortodontskih bravica.[6] Ovaj pristup ima nekoliko prednosti u odnosu na prethodnu tehniku, kada su korišćeni prstenovi za svaki zub ponaosob, kao što su minimiziranje iritacije mekog tkiva i pojava hiperplastičnog gingivita, izostanak posttraumatskih prostora posle uklanjanja prstenova, postavljanje bravica na nedovoljno izrasle zube, mnogo prihvatljiviji estetski izgled za pacijenta. Međutim, da bi izvršili lepljenje bravica neophodno je izvršiti nagrizanje gleđi zuba nekom od kiselina, radi dobijanja adekvatnog retencionog mesta za aplikaciju bravice na površini zuba.

Zbog specifične građe gleđi, za dobru vezu sa adhezivnim materijalom neophodan je predtretman ili kondicioniranje gleđi.

Cilj

Ova studija *in vitro* je urađena sa ciljem:

- da se SEM tehnikom ispita ultrastrukturni izgled bukalnih površina gleđi zuba tretiranih 37% ortofosfornom kiselinom u različitom vremenskom trajanju.

Materijal i metod

Za komparativnu analizu gleđnih površina korišćeno je 20 humanih premolara koji su ekstrahirani iz ortodontskih razloga. Kriterijumi za izbor zuba uključivali su: intaktnu bukalnu površinu koja prethodno nije tretirana nikakvim agensima, bez naprsnuća gleđi usled pritiska klešta za ekstrakciju kao i bez karijesa. Zubi su očišćeni i ispolirani pastom bez fluora u trajanju

Contrary to the process of demineralization, there is a process of remineralization characterized by reparation of hydroxyapatite crystals damaged by acids or creation of new crystals of the apatite enamel. Ultrastructural picture of these changes depends on acid concentration, crystal orientation in relation to teeth surface, but mostly on time needed for the acid to affect the enamel.[4,5]

With appearance of bonding technique, introduced to stomatology by Buonocore in 1955, the concept of bonding different materials to enamel experienced its appliance in orthodoncy serving in bonding of orthodontic brackets.[6] This approach has several advantages like minimizing of soft tissue irritation and appearance of hyper plastic gingivitis, absence of post traumatic spaces after removing of rings, placing the brackets on insufficiently grown teeth, better esthetic look for the patient. However, in order to do bonding of the brackets, it is necessary to do the conditioning of teeth enamel with one of the acids to get the adequate retention places for bracket application on teeth surface.

Pretreatment or conditioning of enamel is necessary because of the specific enamel structure.

Aim

This *in vitro* study was done with this aim:

- To examine the ultra structural look of buccal enamel surfaces treated with 37% phosphorus acid in different time intervals using the SEM technique.

Material and method

For comparative analyses of enamel surfaces, 20 humane premolars, extracted for orthodontic reasons were used for this purpose. Criteria for choosing the teeth included: intact buccal surface previously not treated with any agents, without fissures under the pressure of pliers for extraction, as well as without caries. Teeth were cleaned and polished with a paste without fluorine; time needed for that was

od 5 s. Izvršeno je kondicioniranje zuba unutar eksperimentalnih grupa 37% ortofosfornom kiselinom (Orthodontic Bonding System, Acid Etch, Dentaurum, Nemačka) u različitim vremenskim intervalima od 15, 30 i 45 sekundi.

Zubi su podeljeni u 4 grupe po 5 zuba, 3 eksperimentalne (n=15) i 1 kontrolna (n=5) po sledećem protokolu:

I grupa zuba – kontrolna, bez nagrizanja gleđi;

II grupa zuba – uključivala je zubne uzorke koji su kondicionirani 15 sekundi;

III grupa zuba – kondicionirani 30 sekundi;

IV grupa zuba – kondicionirani 45 sekundi.

Tako dobijeni uzorci su tehnikom spaterovanja u vakuum evaporatoru pripremljeni za SEM analizu (JEOL-JSM-5300).

Rezultati

Ultrastrukturnom analizom gleđnih površina po uklanjanju bravica ustanovljene su značajne razlike između sve četiri grupe, a za komparaciju su korišćene intaktne bukalne površine zuba **I grupe** (slika 1).

Kod **II grupe**, nakon nagrizanja gleđi ortofosfornom kiselinom u trajanju od 15 sekundi, zapaža se početna demineralizacija gleđnih prizmi u vidu "pčelinjeg saća" (slika 2).

5sec.The conditioning of teeth was done with 37% orthophosphoric acid within experimental groups (Orthodontic Bonding System, Acid Etch, Dentaurum, Germany) in different time intervals of 15, 30 and 45 seconds.

Teeth were divided into 4 groups with 5 teeth each, 3 experimental groups (n=15) and 1 control group 1 (n=5) according to the following protocol:

I group – control, without teeth damaging

II group – included teeth samples conditioned for 15 seconds;

III group – conditioned for 30 seconds;

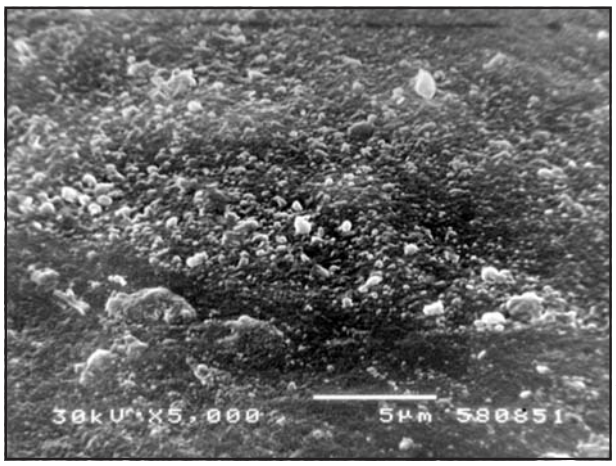
IV group – conditioned for 45 seconds.

Given results were prepared with spattering technique in vacuum evaporator for SEM analyses (JEOL-JSM-5300).

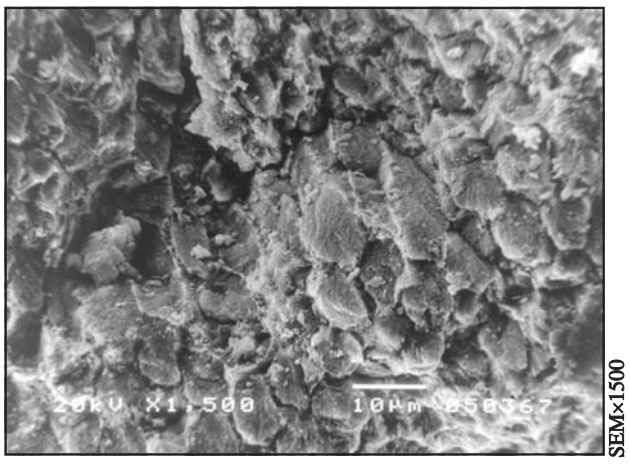
Results

With ultra structural analyses, after brackets removing, significant differences were established among 4 groups. Intact buccal teeth surfaces of I group were used for comparison (figure 1).

The beginning of enamel prisms damaging after orthophosphoric acid (15 seconds) in the shape of "honeycomb" can be noticed with **II group** (figure 2).



Slika 1. Intaktna površina gleđi (kontrolni uzorak)
Figure 1. Intact enamel surface (control sample)



Slika 2. Početna demineralizacija gleđi nakon nagrizanja u trajanju od 15 sec ("pčelinje saće")
Figure 2. Beginning of enamel demineralization after damaging lasting 15 seconds ("honeycomb")

Kod **III grupe** (nagrizanje gleđi izvršeno u trajanju od 30 sec) zapažaju se sledeće mikromorfološke karakteristike:

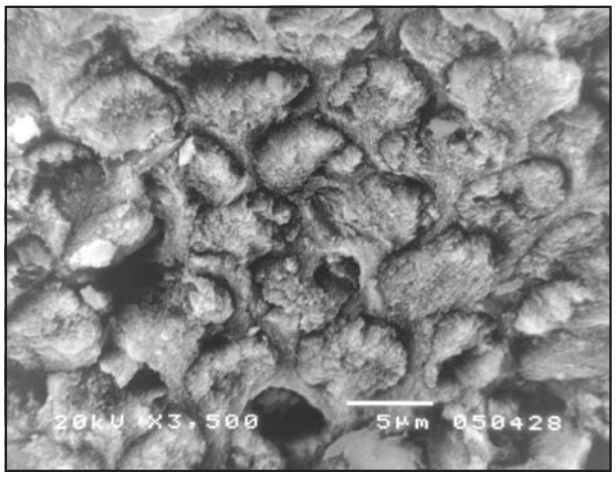
• kiselinska razgradnja periferije prizmatičnih struktura u vidu "riblje krljušti" (slika 3);

• hrapavost i plitke erozije po rubovima gleđnih prizmi u vidu "ukosnica" – demineralizacija tip II (slika 4).

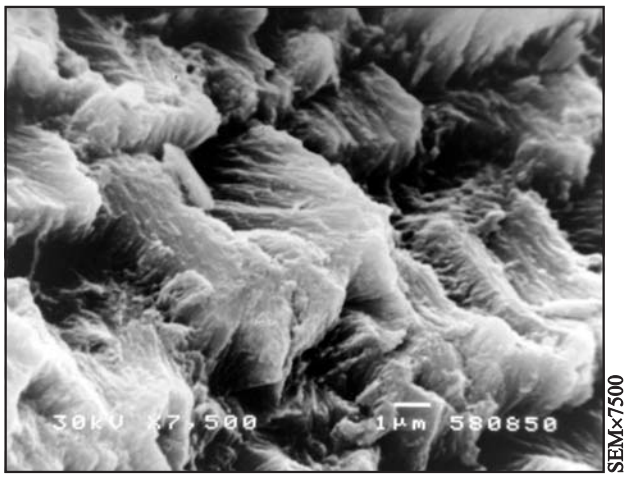
Damaging with **III group** lasted for 30 seconds and we can notice the following micro morphological characteristics:

• Acid razing of the periphery of prismatic structures in the shape of fish scales (figure 3);

• Roughness and shallow erosions on the edges of enamel prisms in the shape of hairpins-demineralization type II (figure 4).



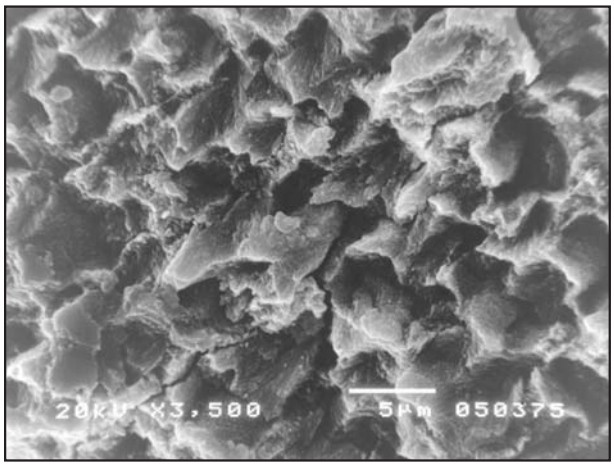
Slika 3. Razgradnja perifernih delova gleđnih prizmi ("riblja krljušt") nakon nagrizanja od 30 sec
Figure 3. Razing of peripheral enamel prisms ("fish scales") after 30 sec damaging



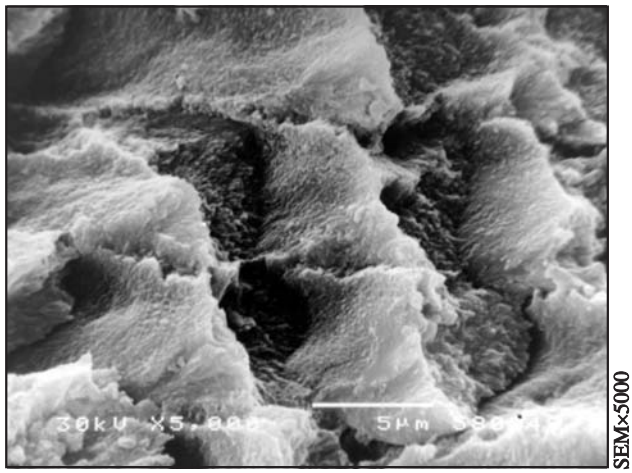
Slika 4. Hrapavost i plitke erozije gleđnih prizmi u vidu "ukosnica" – tip II nakon nagrizanja od 30 sec
Figure 4. Roughness and shallow erosions of enamel prisms in the shape of "hairpins" – type II after 30 sec damaging

Nagrizanje gleđi fosfornom kiselinom u trajanju od 45 sec., koje je izvršeno u **IV grupi**, dovodi do brisanja gleđnog mikroreljefa – demineralizacija sa dominacijom tipa I (slika 5 i 6).

Razing of the enamel with phosphoric acid (45 sec) that was done in **group IV**, brings to erasing of enamel micro relief – demineralization with domination of type I (figure 5, 6).



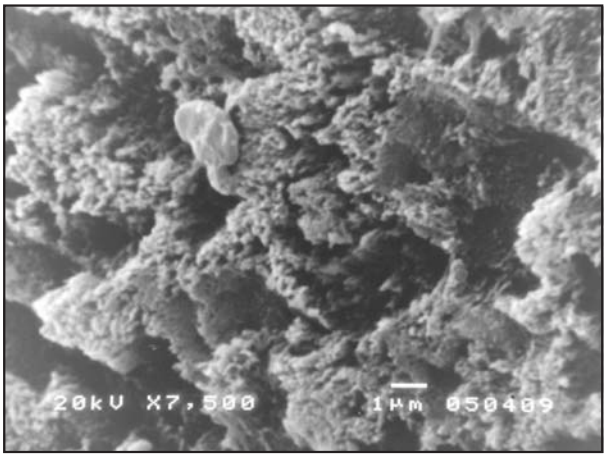
Slika 5. Izražena demineralizacija nakon nagrizanja gleđi u trajanju od 45 sec
Figure 5. Expressed demineralization after enamel razing lasting 45 seconds



Slika 6. Jaka demineralizacija središta gleđnih prizmi i mestimično erodovani rubovi gleđi. Demineralizacija tip I – nagrizanje 45 sec
Figure 6. Strong demineralization of middle part of enamel prisms and here and there on enamel ends. Demineralization type I – lasting 45 seconds

Mikromorfološke promene gleđnih površina kod IV grupe, pokazuju takođe i nazubljene gleđne prizme sa iskidanim ivicama (slika 7).

Micro morphological changes of enamel surfaces with group IV also show cogged enamel prisms with thorn edges (figure 7).



Slika 7. Nazubljene gleđne prizme sa iskidanim ivicama nakon nagrizanja gleđi u trajanju od 45 sec
Figure 7. Cogged enamel prisms with thorn edges after razing of 45 sec

Diskusija

Tradicionalan pristup postavci fiksnih aparata zahteva jednu dosta agresivnu metodu nagrizanja gleđi, kiselinama različite koncentracije koje dovode do demineralizacije gleđi, kao uobičajenog postupka u procesu dobijanja retencionog mesta na površini zuba radi aplikovanja i lepljenja ortodontskih bravica.

Kliničari su zainteresovani kako za karakteristike adhezivnih sistema koje koriste, jer im to omogućava da ga koriste adekvatno i efikasno, tako i za mikromorfološke karakteristike same gleđi, što može biti jedna od smernica za uspešno lepljenje bravica, a time i iznalaženja najadekvatnijeg i najmanje agresivnog terapeutskog postupka u ortodontskoj terapiji fiksnim aparatima.

Gleđ ima izrazito glatku površinu koja, samim tim, nije podesna za mikromehaničko vezivanje sa adhezivnim materijalom. Tehnikom nagrizanja ostvaruje se zadovoljavajuća mikromehanička veza između gleđi i adheziva.

Prvi pokušaj uvođenja adheziva u stomatološku praksu bilo je uvođenje tehnike nagrizanja gleđi kiselinom. Osnovna svrha nagrizanja gleđi ogleda se u poboljšanju fizičke veze (retencije) između adhezivnog materijala i gleđi. Ovim postupkom nagrizanja (kondicioniranja) značajno se povećava aktivna površina gleđi za vezu sa adhezivnim materijalom.

Na uspešnost nagrizanja gleđi utiče više faktora, od kojih su najbitniji: orijentacija površinskih prizmi prema površinskoj ravni, koncentracija i dužina delovanja kiseline.

Discussion

Traditional approach to placing of fixed devices demands one very aggressive method of enamel razing with acids of different concentration which leads to enamel demineralization as a usual procedure in the process of getting the retention place on teeth surface in order to apply and bond the brackets.

Interest for characteristics of adhesive systems and enamel micro morphological characteristics can be one of directions for successful bonding, and this can lead to finding out of most adequate and least aggressive therapeutic procedure in orthodontic therapy with fixed devices.

Enamel has extremely flat surface that is not fit for micro mechanical bonding with adhesive material. Razing technique enables satisfying micro mechanical bond between enamel and adhesive.

The procedure of razing (conditioning) provides the active enamel surface for bonding with adhesive material.

Success of razing depends on several factors and the most important are: orientation of surface prisms towards flat surface, concentration and length of acid effect

When choosing the phosphoric acid, a great number of authors[4,7,9] suggest using of the liquid while gels are more practical because of more precise control during application on enamel surface and they contain sub-micron silicon par-

Pri izboru fosforne kiseline, veći broj autora[4,7,9] zagovara da se koristi u tečnosti, dok gelovi koji su praktičniji, jer se preciznije mogu kontrolisati tokom aplikacije na površinu gleđi, sadrže sub-mikronske silicijumske čestice, koje se teže temeljno ispiraju i uklanjaju, a sa njima i nus produkti demineralizacije gleđi.

Stavovi oko trajanja postupka nagrizanja još uvek su neusaglašeni, ali se smatra da je 30 sekundi optimalno vreme koje može dati odgovarajuće rezultate prilikom procesa lepljenja bravica u ortodontskoj terapiji fiksnim aparatima.

Postoji veliki broj studija o optimalnom vremenu nagrizanja gleđi zuba kod lepljenja bravica. Mišljenja su oprečna. Pojedini autori[7,8,9] sugerišu nagrizanje gleđi u različitim vremenskim intervalima od 15 do 60 sec. po zubu. Međutim, problem leži u činjenici da postoji velika individualna varijacija na rastvorljivost gleđi. Ne samo da smo suočeni sa velikom varijacijom u stepenu rastvorljivosti gleđi zuba među različitim pacijentima, već postoje i razne varijacije među zubima jedne individue, pa čak i u jednom istom zubu.[10,11]

Anatomska površina gleđi zuba utiče u velikoj meri na kvalitet samog kondicioniranja gleđi, pri čemu je svoja zapažanja predstavio i Hobson sa sar.[12] ispitivajući lingvalne površine zuba i upoređujući ih sa bukalnim površinama istih na SEM, i pri tom zapazio da postoje signifikantne razlike u njihovoj strukturi, što je svakako u korelaciji sa morfologijom krunice zuba.

Iznalaženje najoptimalnijeg vremena nagrizanja gleđi zuba kiselinama različite jačine, može biti od presudnog značaja u adekvatnom odabiru adhezivnih sistema[11]. Ispitivanja na SEM nagriženoj površini gleđi zuba fosfornom kiselinom, u različitom vremenskom trajanju, mogu dati odgovor na pitanja ortodontske problematike fiksnim aparatima.[12,13]

Prilikom izlaganja zubnih uzoraka kiselini u trajanju od 30 sekundi u ovoj studiji, zapaža se uglavnom, **razaranje periferije prizmatskih struktura, dok intraprizmatska struktura ostaje relativno intaktna.** Ovaj model destrukcije gleđnih prizmi je u literaturi poznat kao **tip II.**

Delovanje kiseline u trajanju od 45 sekundi izazvalo je veće varijacije u izgledu gleđnih prizmi. Najčešće se zapažao **tip I** sa **disolucijom intraprizmatične strukture.**

Dobijeni rezultati u ovoj studiji mogu se komparirati sa rezultatima Faliana[14] i sar., koji su SEM ispitivanjima ukazali na postojanje četiri tipa nagrižene gleđi:

ticles that are harder to wash and remove together with negative products of enamel demineralization.

Attitudes towards duration of the razing procedure are not uniformed. It is suggested that 30 seconds is the optimum time that can give suitable results during the process of brackets bonding in orthodontic therapy with fixed devices.

There is a great individual variation in enamel dissolving. Not only there is a great variation in the degree of enamel dissolving among different patients but also there are different variations among teeth of one person, even in one tooth.[10,11]

Anatomic enamel surface greatly influences the quality of enamel conditioning. Hobson with assistants[12] examined lingual teeth surfaces and compared them to buccal surfaces of the same teeth on SEM, and noticed significant differences in their structure which is certainly in correlation with the morphology of the tooth crown.

Finding the most optimal time for razing of acids of different strength can be crucial when choosing the adequate adhesive systems.[11] Examinations on SEM razed enamel with phosphoric acid, can give an answer to questions of orthodontic problems with fixed devices.[12,13]

During the exposure of samples to the acid, lasting 30 seconds, **destruction the periphery of prismatic structures is noticed, while intra prismatic structure stays relatively intact**. This model of enamel prisms destruction is known as **type II** in literature.

Acid effect, lasting 45 seconds caused greater variations in enamel prisms look. The most perceived was **type I** with **dissolution of intra prismatic structure**.

The results from this study can be compared with the results of Faliano[14] and assistants, who pointed to 4 types of razed enamel after SEM examination:

1. demineralization of the middle part of the prism,

2. demineralization of the periphery part of the prism,

3. shallow demineralization of central and peripheral prism parts and,

4. unrecognizable irregularly demineralized prisms.

1. demineralizacija centralnog dela prizme,
2. demineralizacija perifernog dela prizme,
3. plitka demineralizacija centralnih i perifernih delova prizmi i
4. neprepoznatljive iregularno demineralizovane prizme.

Demineralizacija centralnog dela prizme u ovoj studiji zapažena je kod IV grupe zuba, nakon kondicioniranja gleđi kiselinom u trajanju od 45 sekundi, demineralizacija perifernog dela prizme zapaža se u III grupi (kondicioniranje gleđi u trajanju od 30 sekundi), dok se plitka demineralizacija centralnih i perifernih delova prizmi primećuje kod II grupe (kondicioniranje gleđi u trajanju od 15 sekundi). Neprepoznatljive iregularno demineralizovane prizme u ovoj studiji nisu notirane, a mogu se očekivati jedino kod dužeg eksponiranja površine gleđi odgovarajućim kiselinama.

Prema rezultatima grupe autora[7], koji su u svom istraživanju ispitivali preseke gleđnih prizmi nakon kondicioniranja 37% ortofosfornom kiselinom u različitom vremenskom trajanju, najprihvatljivije promene u izgledu nagriženih gleđnih površina su zapažene posle delovanja kiseline od 30 sekundi. Uske pukotine koje se pojavljuju na periferiji prizmatskih glava predstavljaju početni stadijum demineralizacije gleđi sa pogodnim mikroretencionim oblikom. Međutim, pojačani gubitak supstance u područjima koja odgovaraju centrima prizmi, pri nešto dužoj izloženosti kiselini, znatno oslabljuju jačinu i otpornost interprizmatične gleđi, što verovatno može rezultirati lomljenjem nežne periferne strukture krajeva gleđnih prizmi. Sa druge strane, predugo eksponiranje gleđi kiselinom briše karakterističnu ultrastrukturnu sliku gleđne supstance zbog proširenja granulacionih i praznih prostora bez postojanja ikakvog reljefa. [8]

Osnovni nedostatak laboratorijskih istraživanja, gde pripada i ova studija je, nemogućnost simuliranja kliničkih uslova, odnosno nedostatak fizioloških činilaca, tkiva i tkivnih tečnosti, što može značajno da utiče na verodostojnost dobijenih podataka.

Zaključak

Na osnovu dobijenih rezultata SEM analize ultrastrukturnih promena gleđi u ovoj *in vitro* studiji, može se zaključiti sledeće:

Demineralization number 1, was noticed with IV group of teeth, after conditioning of the enamel with acid lasting 45 seconds; demineralization 2.was noticed with group III (enamel conditioning lasting 30 seconds), while demineralization 3. was noticed with group II (enamel conditioning lasting 15 seconds). Unrecognizable prisms were not noted in this study and they can be expected only after longer exposure of enamel surface to suitable acids.

The most acceptable changes in the look of razed enamel surfaces were noticed after 30 seconds of exposure to the acid. This is the result of the group of authors[7] who examined the intersections of enamel prisms conditioned with 37% orthophosphoric acid in different time duration. Tight fissures appearing on the periphery of prismatic heads show the beginning of enamel demineralization with suitable micro retentive shape. However, bigger loss of a substance in areas suitable for prism centers, after longer exposure to the acid, significantly weaken the strength and resistance of intra prismatic enamel, which can result in breaking the gentle peripheral structure of the enamel prismatic edges. On the other hand, too long exposure of the enamel to the acid erases the characteristic ultra structural picture of the enamel substance because of extension of granulate and empty spaces without any existing of the relief.[8]

The basic disadvantage of the lab researches, where this study belongs too, is impossibility of simulation of clinical conditions, i.e. the lack of physiological factors, tissues and tissue liquids, which can significantly influence credibility of the given results.

Conclusion

On the basis of the given results of SEM analyses of ultra structural enamel changes, in this *in vitro* study, we can conclude the following:

• Nagrizanje gleđi u trajanju od 15 sec mikromorfološki pokazuje početnu demineralizaciju gleđnih prizama (II grupa);

• Nagrizanje gleđi u trajanju od 30 sec ukazuje na ultrastrukturnu razgradnju središnjeg dela kristala intraprizmatske strukture (demineralizacija tip II);

• Nagrizanje gleđi u trajanju od 45 sec (IV grupa) pokazuje jake mikromorfološke promene gleđne površine sa izraženom nazubljenošću i iskidanim ivicama prizama (sa dominacijom tipa I).

Komparirajući rezultate u ovoj *in vitro* studiji sa rezultatima dobijenim u drugim istraživanjima, dolazi se do zaključka da nagrizanje gleđi u vremenskom trajanju od 30 sekundi, daje najpogodnije mikromorfološke promene u izgledu reljefa gleđi zuba za lepljenje ortodontskih bravica.

• Enamel damaging lasting 15 seconds, micro morphologically shows the beginning of enamel prisms demineralization (group II).

• Enamel damaging, lasting 30 seconds points to ultra structural razing of the middle part of the intra prismatic crystal (demineralization type II);

• Enamel damaging lasting 45 seconds (IV group) shows strong micro morphological changes of enamel surface with noticeable cog and thorn prism edges (with domination of the type I).

Comparing the results in this *in vitro* study to the results from other researches, it can be concluded that damaging of the enamel, lasting 30 seconds, gives the most suitable micro morphological changes in the look of the teeth enamel relief for bonding of orthodontic brackets.

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KONFERENCIJE, KONGRESI I KURSEVI

CONFERENCES, CONGRESSES AND COURSES

March 16, 2006. – March 18, 2006.
2006 Annual Meeting of the Academy of Osseointegration
Seattle, WA, United States

March 17, 2006. – March 17, 2006.
Joint symposium with Faculty of General Dental ractioners - Dental Radiology
Glasgow, Scotland, United Kingdom

March 22, 2006. – March 24, 2006.
The 12th International Dental Congress Of The ECDS
Cairo, Egypt

March 23, 2006. – March 25, 2006.
Thomas P. Hinman Dental Meeting 2006
Atlanta, GA, United States

March 23, 2006. – March 25, 2006.
Fourteenth Annual Dysphagia Research Society Meeting
Scottsdale, AZ, United States

March 24, 2006. – March 24, 2006.
2006 Annual Spring Clinic of the Toledo Dental Society
Sylvania, OH, United States

March 24, 2006. – March 25, 2006.
Clinical Trials Conference - 2006.
Kiev, Ukraine

March 29, 2006. – April 02, 2006.
63rd Annual Session of the American Association of Endodontists
Honolulu, HI, United States

March 30, 2006. – April 02, 2006.
2006 The Kentucky Meeting of the Kentucky Dental Association
Louisville, KY, United States

April 04, 2006. – April 09, 2006.
26th Annual Meeting of the American Society of Laser Medicine and Surgery
Boston, MA, United States

April 04, 2006. – April 05, 2006.
Bridging the Void - The ICR 27th Annual Conference & Exhibition
Manchester, England, United Kingdom

April 06, 2006. – April 08, 2006.
Oregon Dental Conference 2006
Portland, OR, United States

April 27, 2006. – April 30, 2006.
2006 Spring Scientific Session of the California Dental Association
Anaheim, CA, United States

April 27, 2006. – April 30, 2006.
2006 Annual Meeting of the Oklahoma Dental Association
Tulsa, OK, United States

April 27, 2006. – April 29, 2006.
50 Congress du GIRSO (Groupement International de recherche Scientifique en Stomatologie et Odontologie)
Palermo, Italy

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International Dental Implantology Congress, Sharing Experience
Alexandria, Egypt

April 27, 2006. – April 29, 2006.
Pain Management in Women
San Diego, CA, United States

April 27, 2006. – April 29, 2006.
IXth International Symposium on Sjögren's Syndrome
Washington, DC, United States

April 27, 2006. – April 27, 2006.
Esthetic Dentistry and Inlays
Morgantown, WV, United States

April 28, 2006. – May 01, 2006.
2006 Star of the North Meeting of the Minnesota Dental Association
Saint Paul, MN, United States

April 28, 2006. – April 28, 2006.
Dental and Dental Hygiene Student Table Clinics
Morgantown, WV, United States

April 29, 2006. – May 03, 2006.
106th Annual Session of the American Association of Orthodontists
New Orleans, LA, United States