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ISPITIVANJE KORELACIJE NIVOA GUBITKA ALVEOLARNE KOSTI U INTERDENTALNOM I INTERRADIKULARNOM PROSTORU PRIMENOM RADIOGRAFSKE ANALIZE

EXAMINATION OF CORRELATION OF LEVELS OF ALVEOLAR BONE LOSS IN INTERDENTAL AND INTERRADICULAR SPACE USING RADIOGRAPHIC ANALYSIS

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Sažetak

Uvod: *Jedna od posledica prisustva parodontopatije jeste i gubitak alveolarne kosti u interdentalnom i interradikularnom prostoru. Gubitak koštanog tkiva veoma je bitan za procenu težine oboljenja i primenu terapijskih procedura.*
Cilj: *Cilj je bio da se odrede i uporede gubitak interdentalne i interradikularne alveolarne kosti primenom radiografske analize.*
Materijal i metode: *Ispitivano je 100 pacijenata, starosti od 40 do 60 godina, sa hroničnom parodontopatijom, uz zahvaćenost furkacija III i IV stepena kod mandibularnih molara. Nakon ortopantomografskog snimanja urađena su morfološka merenja mezijalnog i distalnog interdentalnog gubitka kosti, kao i merenja interradikularnog prostora, a zatim je analizirana njihova međusobna veza.*
Rezultati: *Srednja vrednost mezijalnog interdentalnog gubitka kosti bila je 5,90 mm ± 2,4 mm, a srednja vrednost distalnog 6,1 mm ± 6,1 mm; srednja vrednost interradikularnog gubitka kosti bila je 3,55 mm ± 5,1 mm. Korelacija između interradikularnog i interdentalnog gubitka kosti bila je statistički značajna ($p < 0,001$). Veća korelacija bila je prisutna kod ispitanika starijih od 50 godina, nego kod mlađih ispitanika. Što se tiče pola, nije uočena statistički značajna razlika između ispitivanih nivoa kostiju. Zapažen je interradikularni gubitak kostiju od 0,8 mm i više kod ispitanika kod kojih je gubitak kostiju na interdentalnom području bio najmanje 3,7 mm.*
Zaključak: *Rezultati istraživanja pokazuju da postoji međusobna veza između gubtika nivoa alveolarne kosti u interdentalnom i interradikularnom prostoru molara kod hronične parodontopatije, pa interdentalni i interradikularni gubitak kosti može poslužiti kao osnova za dodatno ispitivanje u okviru postavljanja dijagnoze oboljenja. Potrebna su dodatna istraživanja koja bi uključila i primenu trodimenzionalne radiografije za određivanje težine oboljenja i terapijskih procedura.*

Ključne reči: *parodontopatija, furkacije zuba, gubitak alveolarne kosti, dijagnoza, terapija*

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Abstract

Introduction: *One of the consequences of the presence of periodontitis is the loss of alveolar bone in the interdental and interradicular space. Bone loss is very important for assessing the severity of the disease and applying therapeutic procedures.*
Aim: *The objective was to determine and compare the loss of interdental and interradicular alveolar bone using radiographic analysis.*
Material and methods*: 100 patients, aged 40 to 60 years, with chronic periodontitis andinvolvement of grade III and IV furcations in mandibular molars were examined. After orthopantomographic imaging, morphological measurements of mesial and distal interdental bone loss were performed, as well as the measurements of interradicular space. Then, their interrelationship was analyzed.*
Results: *The mean value of mesial interdental bone loss was 5.90 ± 2.4mm, and the mean value of distal was 6.1 ± 6.1mm, while the mean value of interradicular bone loss was 3.55 ± 5.1mm. The correlation between interradicular and interdental bone loss was statistically significant ($p<0.001$). A higher correlation was present in respondents older than 50 years compared to younger respondents. Regarding gender, no statistically significant difference was observed between the examined bone levels. Interradicular bone loss of 0.8 mm and more was observed in subjects with bone loss in the interdental area of at least 3.7 mm.*
Conclusion: *The results show that there is a correlation between the loss of alveolar bone levels in the interdental and interradicular space of the molars in chronic periodontitis, so interdental and interradicular bone loss can be used as an additional test in diagnosing the disease. Additional research is needed, which would include the use of three-dimensional radiography to determine the severity of the disease and therapeutic procedures.*

Key words: *periodontitis, tooth furcation, alveolar bone loss, diagnosis, therapy*

Uvod

Parodontalno oboljenje jedno je od najčešćih oboljenja kod ljudi, a odlikuje se prisustvom inflamacije i destrukcijom parodontalnog tkiva[1,2]. Parodontalno oboljenje karakterišu periodi egzacerbacije bolesti, u kojima se potporne strukture zuba uništavaju pod dejstvom endotoksina raznih parodontopatogena, praćeni vremenskim periodima latencije[3]. Progresija parodontopatije izaziva gubitak vezivnog tkiva, gubitak alveolarne kosti i, posledično, labavljenje i migraciju zuba.

Izraz „zahvaćenost furkacija" odnosi se na destrukciju bifurkacijskih i trifurkacijskih prostora višekorenskih zuba parodontalnim oboljenjem[2]. Prostori furkacije predstavljaju jedan od najvećih izazova u terapiji parodontalnog oboljenja. U nekoliko retrospektivnih studija o gubitku zuba zabeleženo je da upravo zubi sa furkacijama imaju veći mortalitet i kompromitovanu prognozu po pitanju terapije od drugih zuba[4,5]. Razlog destrukcije parodonta može biti horizontalni gubitak kostiju ili kosa resorpcija sa pojavom infrakoštanih defekata – tada furkacijski prostori postaju mesto akumulacije oralnog biofilma i detritusa[2,6]. Budući da su ulazi u furkacijski prostor često premali za tretman odgovarajućim instrumentima ili pravilnu kućnu oralnu higijenu[7], maksilarni i mandibularni višekoreni zubi su u većem riziku od bržeg gubitka, uz kompromitovanu dugoročnu prognozu bolesti[8]. Stoga, defekti u furkacijama predstavljaju značajan problem u terapiji parodontopatije[9], što nalaže ranu dijagnozu i lečenje.

U većini slučajeva dijagnoza parodontalnog oboljenja uglavnom zavisi od kliničkih znakova i simptoma. Ipak, za pružanje informacija o vrsti, obimu i težini parodontopatije klinički pregled nekada nije dovoljan[10]. Postoji nekoliko nedostataka u kliničkom pregledu koji mogu negativno uticati na p ostavljanje d ijagnoze p arodontopatije: prisustvo i stepen zapaljenja, konzistencija gingivnog tkiva, pritisak primenjen prilikom sondiranja, tip, veličina i oblik sonde, lokacija i ugao prilikom sondiranja itd[11-14]. U slučajevima gubitka kostiju, radiografski pregled može se koristiti kao dodatna dijagnostička metoda[10,15-16].

Međutim, konvencionalnom radiografskom procenom ne može se tačno odrediti količina gubitka kostiju. Digitalno merenje, tj. radio-vizuelna grafika (RVG) može poboljšati

Introduction

Periodontal disease is one of the most common diseases in humans, and is characterized by the presence of inflammation and destruction of periodontal tissue[1,2]. Periodontal disease is characterized by periods of exacerbation of the disease, in which the supporting structures of the teeth are destroyed by endotoxins of various periodontopathogens, which are followed by periods of latency[3]. Progression of periodontitis causes loss of connective tissue, loss of alveolar bone and consequent loosening and migration of teeth.

The term "furcation involvement" refers to the destruction of bifurcation and trifurcation spaces of multi-rooted teeth by periodontal disease[2]. Furcation spaces represent one of the greatest challenges in the treatment of periodontal disease. In several retrospective studies on tooth loss, it has been noted that teeth with furcation's have a higher mortality and compromised prognosis in terms of therapy, compared to other teeth[4,5]. The reason for the destruction of the periodontium can be horizontal bone loss or oblique resorption with the appearance of infraosseous defects. Then the furcation spaces become a place of accumulation of oral biofilm and detritus[2,6]. Entrances to the furcation space are often too small for treatment with appropriate instruments or proper home oral hygiene[7]. Therefore, maxillary and mandibular multi-rooted teeth are at higher risk for faster loss with compromised long-term prognosis[8]. Therefore, defects in furcation's are a significant problem in periodontal therapy[9] which requires early diagnosis and treatment.

In most cases, the diagnosis of periodontal disease mainly depends on the clinical signs and symptoms. However, to provide information on the type, extent and severity of periodontitis, a clinical examination is sometimes not sufficient[10]. There are several shortcomings in a clinical examination that may adversely affect the diagnosis of periodontitis, such as the presence and degree of inflammation, gingival tissue consistency, probing, type, size and shape of probe, location and angle when probing, etc.[11-14]. In cases of bone loss, radiographic examination may be used as an additional diagnostic method[10,15-16].

However, by conventional radiographic assessment, the amount of bone loss cannot be accurately determined.

dijagnostičku interpretaciju radiografskih snimaka u smislu tačnosti, mada je pokazano da se validnost linearnih merenja gubitka kostiju ne može poboljšati osnovnim digitalnim manipulacijama[17].

Vivek i sar.[14] tvrde da, čak i uz redovno održavanje oralne higijene, parodontopatija na mestima furkcije napreduje različitom brzinom u odnosu na ostale površine zuba i da pogođena mesta teže većem gubitku nivoa kliničkog pripoja, bez obzira na terapiju koja se pruža. Međutim, mora se nagovestiti da su ovi autori procenjivali podatke samo za promenu dubine kliničkog pripoja na mestu furkacije, bez procenjivanja promena kliničkog pripoja za ostale površine zuba. Kim i sar.[18] u svom stereomikroskopskom istraživanju 34 ekstrahirana molara izveštavaju o tome da su gubitak pripoja i marginalni gingivitis na površinama okrenutim prema furkacijama veći od onih na spoljnim površinama. Postoji veoma mali broj studija koje su upoređivale brzinu gubitka kosti na mestu furkacije i interdentalnog septuma istog zuba. Prag gubitka alveolarne kosti, koji je povezan sa progresijom razaranja parodonta i zahvatanjem interradikularnih prostora, nije u literaturi jasno definisan. Potreba za proučavanjem proističe iz činjenice da treba saznati da li se gubitak interdentalnih septuma može koristiti kao dodatni vodič za sveobuhvatnu dijagnozu parodontalnog oboljenja pomoću RVG .

Cilj ove studije bio je da se radiografskom procenom istraži veza između interradikularne destrukcije kosti i interdentalnog gubitka kostiju kod pacijenata sa hroničnom parodontopatijom.

Materijal i metode

Istraživanje je sprovedeno u Službi za parodontologiju i oralnu medicinu Klinike za dentalnu medicinu u Nišu. U ovo istraživanje uključeno je 100 pacijenata (56 muškaraca i 44 žene) starosti od 40 do 60 godina, kojima je dijagnostikovana hronična parodontopatija. Svi pacijenti su informisani o prirodi istraživanja, nakon čega je dobijena i njihova pismena saglasnost.

Kriterijumi za uključivanje u istraživanje bili su:

1. pacijenti koji imaju hroničnu parodontopatiju sa gubitkom pripojnog epitela ≥ 4 mm na 30% ili više mesta;
2. starosna grupa pacijenata od 40 do 60 godina;

Digital measurement, i.e., Radio Visio Graphy (RVG) can improve the diagnostic interpretation of radiographs in terms of accuracy, although it has been shown that the validity of linear bone loss measurements cannot be improved by basic digital manipulations[17].

Vivek et al.[14] claim that, even with regular maintenance of oral hygiene, periodontitis at the sites of furcation progresses at different speed than onother tooth surfaces and that the affected sites tend to lose more levels of clinical adhesion, regardless of the therapy provided. However, it must be suggested that these authors evaluated the data only for the change in the depth of clinical adhesion at the site of furcation, without estimating the changes in clinical adhesion for other tooth surfaces. Kim et al.[18] in his stereomicroscopic examination of 34 extracted molars report that the loss of adhesion and marginal gingivitis on the surfaces facing the furcationsaregreater than thoseon the outer surfaces. There are very few studies that have compared the rate of bone loss at the site of furcation and the interdental septum of the same tooth. The threshold of alveolar bone loss associated with progression of periodontal destruction and interradicular space involvement has not been clearly defined in the literature. There is a need to learn whether the loss of interdental septa can be used as an additional guide for a comprehensive diagnosis of periodontal disease using RVG.

The aim of this study was to investigate the link between interradicular bone destruction and interdental bone loss in a patient with chronic periodontitis.

Material and methods

This study was conducted in the Department of Periodontology and Oral Medicine of the Clinic of Dental Medicine in Niš. This study included 100 patients (56 men and 44 women) aged 40 to 60 who were diagnosed with chronic periodontitis. All patients were informed about the nature of the research, after which their written consent was obtained.

Criteria for inclusion in the study were:

1. patients with chronic periodontitis with loss of adnexal epithelium ≥ 4 mm, that is,of 30% or more;
2. age group of patients from 40 to 60 years;

3. prisustvo mandibularnog 1. i 2. molara;
4. pravilno postavljeni mandibularni molari (bez dijastema, bez teskobe, bez rotacije);
5. pacijenti voljni da daju saglasnost za ovo istraživanje.

Kriterijumi za isključenje iz istraživanja bili su:
1. pacijenti sa sistemskom bolešću;
2. pacijenti koji su bili podvrgnuti parodontalnoj terapiji u poslednjih šest meseci;
3. molari sa spojenim korenima;
4. mandibularni molari bez kontakta sa antagonistom;
5. uslovi koji ometaju kliničku / rendgenografsku procenu, kao što su ortodontska žica, obimni konzervativni radovi, prekomerno prisustvo čvrstih naslaga, zbog čega se ne može se identifikovati gleđno-cementna granica;
6. pacijenti koji su na terapiji lekovima, koji ometaju metabolizam kostiju;
7. trudnice.

Klinički pregled urađen je kod svih ispitanika korišćenjem parodontalnih parametara, i to : a) dubina parodontalnog džepa (DPDž) pomoću Michigan 0 parodontalne sonde; b) nivo pripojnog epitela (NPE) korišćenjem Michigan 0 parodontalne sonde; c) gingivalni indeks po Löe–Silnessu (1963).

Ortopantomografsko snimanje mandibularnih molara urađeno je kod svih ispitanika paralelnom tehnikom (tehnika dugog konusa / tehnika pod pravim uglom) – korišćen je komercijalno dostupan rendgen aparat, uz pravilno pridržavanje standarda zaštite od zračenja i u aseptičnim uslovima. Na ortopantomografskom snimku identifikovani su anatomski detalji, gleđno-cementna granica, horizontalna, vertikalna i interradikularna resorpcija kosti:
• gleđno-cementna granica – alveolarni greben (kod horizontalne destrukcije kosti);
• gleđno-cementna granica – apikalni defekt kosti (kod vertikalne destrukcije kosti);
• furkacijski forniks – interradikularni očuvani nivo kosti – udaljenost od furkacionog forniksa do netaknute interradikularne kosti (interradikularni gubitak kosti).

Zahvaćenost furkacija kod mandibularnih molara procenjivana je pomoću aproksimalne kalibrisane parodontalne sonde, graduisane intervalima od 2 mm (Hu Friedy, Chicago, IL, USA).

3. presence of mandibular 1st and 2nd molars;
4. properly placed mandibular molars (no diastema, no anxiety, no rotation); and
5. patients who were willing to consent to this research.

Criteria for exclusion from the study were:
1. patients with systemic disease;
2. patients who hadundergone periodontal therapy in the last 6 months;
3. molars with fused roots;
4. mandibular molars without contact with antagonist;
5. conditions that interfere with clinical/radiographic assessment such as orthodontic wire, extensive conservative work, excessive presence of solid deposits due to which the enamel-cement boundary cannot be identified;
6. patients on therapy with drugs that interfere with bone metabolism; and
7. pregnant women.

Clinical examination was performed in all subjects using periodontal parameters, namely: a) depth of periodontal pocket (DPJ)—using Michigan 0 periodontal probe; b) level of adnexal epithelium (NPE)—using Michigan 0 periodontal probe; and c) gingival index according to Löe and Silness (1963).

Orthopantomographic imaging of mandibular molars was performed in all subjects bya parallel technique (long cone technique/right angle technique) using a commercially available X-ray machine with proper adherence to radiation protection standards and in aseptic conditions. On the orthopantomographic image, anatomical details, enamel-cement border, horizontal, vertical and interradicular bone resorption were identified:
• cement-enamel junction—alveolar ridge (in horizontal bone destruction)
• cement-enamel junction—apical bone defect (in vertical bone destruction)
• furcation fornix—interradicular preserved bone level—distance from furcation fornix to intact interradicular bone (interradicular bone loss).

Furcation involvement in mandibular molars was assessed using an approximate calibrated periodontal probe, graduated at 2 mm intervals (Hu Friedy, Chicago, IL, USA).

Statistička analiza

Rezultati za svaki parametar za diskretne podatke i prosečne vrednosti (SV ± SD) predstavljeni su u tabelama i slikama. Pearsonovi koeficijenti korelacije izračunati su kako bi se utvrdilo da li postoji povezanost između interdentalnog i interradikularnog gubitka kosti. U svim pomenutim testovima P vrednost manja od 0,05 uzeta je za statistički značajnu. Podaci su analizirani pomoću SPSS paketa (ver. 18.0).

Rezultati

Ovim istraživanjem vršilo se utvrđivanje veze između interdentalnog i interradikularnog gubitka kostiju, sa veličinom uzorka od 100 pacijenata. Muškaraca je bilo 56 (56%), dok je žena bilo 44 (44%). Minimalna starost pacijenta bila je 40 godina, a maksimalna 60 godina. Prosečna starost pacijenta bila je 49,91 godina ± 2,16 godina. Učesnici su deljeni i u dve starosne grupe sa granicom od 50 godina; većina pacijenata bila je u kategoriji mlađih od 50 godina – njih 54 bilo je prosečne starosti od 44,28 godina ± 2,58 godina. (Tabela 1)

Vrednosti minimalnog i maksimalnog mezijalnog interdentalnog gubitka kostiju među uzorcima dobrovoljaca jesu 3,10 mm i 9,50 mm. Izračunata srednja vrednost iznosi 5,90 mm. Vrednosti minimalnog i maksimalnog distalnog interdentalnog gubitka kostiju kod dobrovoljaca jesu 3,53 mm i 9,80 mm. Srednja vrednost distalnog interdentalnog gubitka kosti izračunata je na 6,10 mm. Vrednosti standardne devijacije mezijalnog i distalnog interdentalnog gubitka kostiju jesu 2,4 i 6,10 mm. Navedeno dokazuje da postoji veće odstupanje u distalnom interdentalnom gubitku kostiju u poređenju sa gubitkom mezijalnog interdentalnog gubitka kosti.
Zabeležene vrednosti minimalnog i maksimalnog interradikularnog gubitka kosti kod dobrovoljaca jesu 1,34 mm i 10,00 mm. Srednje vrednosti i vrednosti standardnog odstupanja zabeležene su kao 3,55 mm i 5,1 mm.(Tabela 2).

Statistical analysis

The results for each parameter for discrete data and average values (mean ± SD) for each parameter are presented in tables and figures. Pearson's correlation coefficients were calculated to determine if there was an association between interdental and interradicular bone loss. In all of the above tests, a P value less than 0.05 was considered statistically significant. Data were analyzed using the SPSS package (ver. 18.0).

Results

This study was conducted to determine the relationship between interdental and interradicular bone loss, with a sample size of 100 patients. There were 56 (56%) men and 44% women. The minimum age of the patient was 40 years, and the maximum was 60 years. The mean age of the patient was 49.91±2.16. Participants were also divided into two age groups with a limit of 50 years, where most patients were in the category younger than 50 years, 54 of them with an average age of 44.28±2.58 (Table 1).

The values of minimum and maximum mesial interdental bone loss among the volunteer samples were 3.10 mm and 9.50 mm. The mean value calculated is 5.90 mm. The values of minimum and maximum distal interdental bone loss in volunteers are 3.53 mm and 9.80 mm. The mean value of distal interdental bone loss was calculated at 6.10 mm. The values of the standard deviation of mesial and distal interdental bone loss are 2.4 and 6.10. This proves that there is a larger deviation in distal interdental bone loss compared to the loss of mesial interdental bone loss. The values of minimum and maximum interradicular bone loss in volunteers were recorded as 1.34 mm and 10.00 mm. Mean and standard deviation values were recorded as 3.55 and 5.1. (Table 2).

Tabela 1. Polna i starosna struktura učesnika
Table 1. Gender and age structure of participants

Varijabile / Variable	**PD***	
	(n = 100)	**%**
Pol / Gender Muški/Male	56	(56 %)
Ženski/Female	44	(44 %)
Godine / Ages (SV ± SD) / (mean ± SD)	49.91 ± 2.16	
Raspon godina / Range of yrs	40–60	
≤ 50 god / yrs. (n, SV ± SD / n, mean ± SD)	(54)	44.28 ± 2.58
> 50 god / yrs. (n, SV ± SD / n, mean ± SD)	(46)	55.91 ± 3.64

*PD - Periodontal disease

Tabela 2. Srednje vrednosti interdentalnog i interradikularnog gubitka kosti
Table 2. Mean values of interdental and interradicular bone loss

Varijabile/Variable	n (broj/number)	SV/mean	SD*	Median	Min.	Max.
Mezijalni interdentalni gubitak kosti / Mesial interdental bone loss	100	5.90	2.4	4.67	3.10	9.50
Distalni interdentalni gubitak kosti / Distal interdental bone loss	100	6.10	6.10	5.58	3.53	9.80
Interradikularni gubitak kosti/ Interradicular bone loss	100	3.55	5.1	3.41	1.34	10.00

*SD – standard deviation

Srednja vrednost mezijalnog interdentalnog gubitka kosti je 5,90 mm ± 2,4 mm, a srednja vrednost distalnog interdentalnog gubitka kostiju 6,10 mm ± 6,10 mm, što sugeriše da je distalni interdentalni gubitak kosti veći od gubitka mezijalnog interdentalnog gubitka kosti. Ipak, razlika između mezijalnog interdentalnog gubitka kosti i distalnog interdentalnog gubitka kosti nije značajna, budući da je p = 0,418 3 (T abela 3). Korelacija između mezijalnog interdentalnog gubitka kosti i distalnog interdentalnog gubitka kosti je snažna i ima pozitivan odnos – kao Pearsonova korelacija (r) vrednost je 0,503 (Tabela 3).

Srednja vrednost mezijalnog interdentalnog gubitka kosti jeste 5,90 mm ± 2,4 mm, a srednja vrednost interradikularnog gubitka kosti 3,55 mm ± 5,10 mm; razlika između mezijalnog gubitka kosti i interradikularnog gubitka kosti je značajna, budući da je p < 0,001.

The mean value of mesial interdental bone loss was 5.90±2.4 mm, and the mean value of distal interdental bone loss was 6.10±6.10 mm, suggesting that distal interdental bone loss was higher compared to the loss of mesial interdental bone loss. But the difference between mesial interdental bone loss and distal interdental bone loss was not significant as p=0.418 (Table3).The Pearson correlation (r) value of 0.503 confirmed strong and positive relationship (correlation) between mesial interdental bone loss and distal interdental bone loss (Table3).

The mean value of mesial interdental bone loss was 5.90±2.4 mm, and the mean value of interradicular bone loss was 3.55±5.10 mm, and the difference between mesial bone loss and interradicular bone loss was significant with p<0.001. The correlation between mesial interdental bone loss and interradicular bone loss was moderately positive with Pearson's correlation value (r) of 0.376 (Table3).

Korelacija između gubitka mezijalne interdentalne kosti i interradikularnog gubitka kosti je umereno pozitivna, jer je Pearsonova korelaciona vrednost (r) 0,376 (Tabela 3).

Srednja vrednost distalnog interdentalnog gubitka kosti jeste 6,10 mm ± 6,10 mm, a srednja vrednost interradikularnog gubitka kosti 3,55 mm ± 5,10 mm; razlika između distalnog interdentalnog gubitka kosti i interradikularnog gubitka kosti je značajna, budući je $p < 0,001$. Korelacija između gubitka distalne interdentalne kosti i interradikularnog gubitka kosti je jako pozitivna, jer Pearsonova korelaciona vrednost (r) iznosi 0,405 (Tabela 3).

Zapaženo je da ispitanici stariji od 50 godina imaju veći stepen korelacije za distalni interdentalni i interradikularni gubitak kostiju; mlađi od 50 godina imali su pak veću korelaciju za mezijalni interdentalni i interradikularni gubitak kostiju. Stoga, korelacija između interradikularnog i interdentalnog gubitka kosti kod ispitanika starijih od 50 godina bila je značajna (Tabela 4). Što se tiče pola, kod žena je postojao veći stepen korelacije za mezijalni interdentalni i interradikularni gubitak kostiju, dok su muškarci imali veću korelaciju između distalnog interdentalnog i interradikularnog gubitka kosti. Dakle, kada se u obzir uzme pol, korelacija između interradikularnog i interdentalnog gubitka kosti nije bila značajna (Tabela 4).

The correlation between mesial interdental bone loss and interradicular bone The mean value of distal interdental bone loss was 6.10±6.10 mm, and the mean value o f interradicular bone loss was 3.55±5.10 mm, and the difference between distal interdental bone loss and interradicular bone loss was significant as $p<0.001$. The Pearson's correlation value (r) of 0.405 confirmed very positive correlation between distal interdental bone loss and interradicular bone]It was observed that participants older than 50 years had a higher degree of correlation ofdistal interdental and interradicular bone loss; younger than 50 years had a higher correlation ofmesial interdental and interradicular bone loss. Therefore, the correlation between interradicular and interdental bone loss in subjects older than 50 years was significant (Table 4). Regarding gender, females had a higher degree of correlation for mesial interdental and interradicular bone loss, while males had a higher correlation between distal interdental and interradicular bone loss. Thus, when gender was taken into account, the correlation between interradicular and interdental bone loss was not significant (Table 4).

Tabela 3. Korelacija između interdentalnog i interadikularnog gubitka kosti
Table 3. Correlation between interdental and interadicular bone loss

	n (broj /number)	SV/ mean	SD/ SD	Razlika/ Difference	SD razlike / SD difference	P value	Pirsonova korelacija (r) / Pearsons correlation (r)
Mezijalni interdentalni gubitak kosti / Mesial interdental bone loss	100	5.90	2.4	-0.20	2.389	0.418	0.503
Distalni interdentalni gubitak kosti / Distal interdental bone loss	100	6.10	6.10				
Mezijalni interdentalni gubitak kosti / Mesial interdental bone loss	100	5.90	2.4	2.35	2.426	***< 0.001***	0.376

Interradikularni gubitak kosti / Interadicular bone loss	100	3.55	5.10				
Distalni interdentalni gubitak kosti / Distal interdental bone loss	100	6.10	6.10	2.55	2.777	***< 0.001***	0.405
Interradikularni gubitak kosti / Interadicular bone loss	100	3.55	5.10				

Tabela 4. Korelacija između interdentalnog i interradikularnog gubitka kostiju na osnovu starosti i pola

Table 4. Correlation between interdental and interradicular bone loss based on age and gender

		n (broj/number)	Interdentalni gubitak kosti / Interradicular bone loss	Interradikularni gubitak kosti / Interdental bone loss	p vrednost / p value
Godine/ Ages	≤ 50	46	Mezijalni/ Mesial	r = 0.569	***0.006***
			Distalni/ Distal	r = 0.341	0,121
	> 50	54	Mezijalni/ Mesial	r = 0.297	0.125
			Distalni/ Distal	r = 0.475	***0.011***
Pol/ Gender	Muški/ Male	56	Mezijalni/ Mesial	r = 0.353	0.044
			Distalni/ Distal	r = 0.434	***0,012***
	Ženski/ Female	44	Mezijalni/ Mesial	r = 0.402	***0.110***
			Distalni / Distal	r = 0.362	0.154

Diskusija

Jedna od glavnih posledica parodontopatije jeste destrukcija alveolarne kosti. Oštećenja kostiju oko zuba su specifična i nisu predvidljiva u pogledu oblika, obima i položaja. U većini slučajeva dijagnoza parodontalnog oboljenja uglavnom zavisi od kliničkih nalaza. Međutim, odlučivanje za terapijske procedure vezane za lečenje može se dopuniti radiografskom procenom nivoa i karakteristika defekta alveolarne kosti, koja služi kao dodatak kliničkom pregledu[19].

Discussion

One of the main consequences of periodontitis is the destruction of the alveolar bone. Bone damage around the teeth is specific and unpredictable in terms of shape, extent, and position. In most cases, the diagnosis of periodontal disease mainly depends on clinical findings. However, deciding on therapeutic procedures related to treatment can be supplemented by radiographic assessment of the level and characteristics of the alveolar bone defect, which serves as an adjunct to the clinical examination[19].

Saniranje molara sa zahvaćenim furkacijama predstavlja jedan od glavnih izazova u kliničkoj parodontologiji[20,21]. Zahvaćenost furkacija kod molara rezultira manje povoljnim ishodom parodontalne terapije i povećanim rizikom od gubitka zuba[22,18]. Zbog toga, za adekvatno donošenje odluka neophodna je tačna dijagnoza stepena furkacije, što značajno utiče na lečenje. Parodontolog se oslanja na podatke iz kliničkih pregleda i radiografskih snimaka. Međutim, opšte je pravilo da je gubitak kostiju uvek veći od onog koji se pojavljuje na radiografiji[22]. Prema tome, moguće je da uključenje furkacije bude prisutno bez radiografskih promena[22]

U metodologiji ovog istraživanja, korišćena je ortopantomografija za procenu gubitka kosti radi ispitivanja korelacije interdentalnog i interradikularnog gubitka kosti pomoću RVG, što je bilo slično istraživanjima drugih autora[18,23,24,25,26]. Ortopantomografska tehnika je jednostavna, a merenja se mogu lako izvesti pomoću različitih mehaničkih i digitalnih mernih alata.

Da bi se proverila povezanost interdentalnog i interradikularnog gubitka kostiju u različitim uzrastima, izabrani su volonteri iz dveju različitih starosnih grupa (≤ 50 godina i > 50 godina), s tim što većina pacijenata spada u kategoriju stariju od 50 godina. Kada je reč o polu, napominjemo da se uzorak uglavnom sastoji od muškaraca.

Prosečna starost grupe je 49,91 godina ± 2,16 godina. Kod pacijenata mlađih od 50 godina uočen je veći stepen korelacije za mezijalni interdentalni i interradikularni gubitak kosti, dok stariji od 50 godina imaju veću korelaciju za distalni interdentalni i interradikularni gubitak kostiju. Stoga je korelacija između interradikularnog i interdentalnog gubitka kosti u grupi iznad 50 godina bila značajna. To je u skladu sa studijom čiji su autori Schei O i sar.[27], u kojoj je pokazano da se resorpcija alveolarne kosti povećava sa starenjem. Drugo istraživanje koje je sproveo Hugoson[28] pokazalo je da u starosnim grupama od 40, 50 i 70 godina nijedan ispitanik nije bio bez vidljivih znakova parodontopatije.

Što se tiče pola, uočeno je da je kod žena postojao veći stepen korelacije za mezijalni interdentalni i interradikularni gubitak kostiju, dok su muškarci imali veću korelaciju između distalnog interdentalnog i interradikularnog gubitka kosti.

Restoration of molars with affected furcationsrepresents one of the main challenges in clinical periodontology[20,21]. Furcation involvement in molars results in a less favourable outcome of periodontal therapy and an increased risk of tooth loss [22,18]. Therefore,for adequate decision-making, an adequate diagnosis of the degree of furcation is necessary, which significantly affects the treatment. The periodontist relies on data from clinical examinations and radiographs. However, as a general rule, bone loss is always greater than what appears on radiographs[22]. Therefore, it is possible for furcation involvement to be present without radiographic changes[22].

In the methodology of this research, orthopantomography was used to assess bone loss to examine the correlation of interdental and interradicular bone loss using RVG, which was similar to research by other authors[18,23,24,25,26]. The orthopantomographic technique is simple, and measurements can be easily performed using various mechanical and diTo verify the association between interdental and interradicular bone loss at different ages, volun teers from two different age groups (≤50 years and> 50 years), were selected with mostpatients falling into the category older than 50 years. In relation to gender, the sample mainly consisted of men.

The mean age of the group was 49.91±2.16 years. In patient younger than 50 years, a higher degree of correlation o fmesial interdental and interradicular bone losswas observed, while those older than 50 years had a higher correlation of distal interdental and interradicular bone loss. Therefore, the correlation between interradicular and interdental bone loss in the group over 50 years was significant. This is in accordance with the study conducted by Schei O et al.[27] who showed that alveolar bone resorption increases with age. Another study conducted by Hugoson[28] showed that in the age groups of 40, 50 and 70, no subject was without it wvisible signs of periodontitis. Regarding gender, as observed that females had a higher degree of correlation for mesial interdental and interradicular bone loss, while males had a higher correlation between distal interdental and interradicular bone loss.

Dakle, na osnovu pola, korelacija između interradikularnog i interdentalnog gubitka kosti nije bila značajna. Ovo je podržano longitudinalnom studijom koju su sproveli Rohner i sar.[29] – u njoj starost, pol i profesionalni status ne utiču na godišnju stopu resorpcije alveolarne kosti.

Grover i sar[30] su u svojoj studiji pokazali da su vrednosti u rasponu od 2,40 mm do 10,50 mm za mezijalni, a one u rasponu od 2,90 mm do 12,90 mm za distalni interdentalni gubitak kostiju povezane sa interradikularnim gubitkom kosti u rasponu od 0,80 mm do 9,70 mm; oboje su bili značajno korelirani jedni sa drugima ($p < 0,001$). Rezultati dobijeni u našoj studiji, gde je srednja vrednost mezijalnog interdentalnog gubitka kosti 5,90 mm ± 2,4 mm, a srednja vrednost distalnog interdentalnog gubitka kosti 6,10 mm ± 6,10 mm povezana sa interradikularnim gubitkom kosti u opsegu 3,55 ± 5,10 mm. Korelacija između mezijalnog interdentalnog gubitka kostiju i interradikularnog gubitka kosti je umereno pozitivna, jer Pearsonova korelaciona (r) vrednost iznosi 0,376. Korelacija između distalnog interdentalnog gubitka kosti i interradikularnog gubitka kosti je jako pozitivna, jer Pearsonova korelacija (r) iznosi 0,405.

Rezultati ove studije otkrili su da je najmanji iznos interradikularnog gubitka kosti od oko 0,34 mm i više primećen samo kada je gubitak kostiju na interdentalnom području jednak 2,10 mm ili veći od toga, što je slično rezultatima koje su dobili Popova i sar.[25], sprovevši studiju u cilju istraživanja veze između interradikularnog razaranja kostiju i interdentalnog gubitka kostiju kod pacijenata sa hroničnom parodontopatijom; tu je gubitak kosti u fukcijama sa opsegom od 1 mm i više bio u korelaciji sa interdentalnim gubitkom kostiju iznad 4 mm.

U skladu sa rezultatima ovog istraživanja jeste i istraživanje koje su sproveli Clara S Kim i sar.[18] kako bi utvrdili da li zubi sa zahvaćenim furkacijama vremenom gube značajno više kosti na mestu furkacije u odnosu na interproksimalna mesta istog zuba; pokazalo se da se promena nivoa kosti u toku vremena kreće u proseku 4,22% za interproksimalna mesta i 4,55% za mesta furkacije.

Određivanje interdentalnog gubitka kosti može se koristiti kao skrining alat za otkrivanje bolesti u ranoj fazi, posebno kada se ima u vidu da je lečenje zahvaćenih furkacija u poodmaklom stadijumu složeno, skupo, dugotrajno i zahteva interdisciplinarni pristup.

Thus, based on gender, the correlation between interradicular and interdental bone loss was not significant. This is supported by a longitudinal study conducted by Rohner et al.[29] in whichage, gender, and professional status do not affect the annual rate of alveolar bone resor ption.

Grover et al. in their study showed that values ranging from 2.40 to 10.50 mm for mesial and those ranging from 2.90 to 12.90 mm for distal interdental bone loss were associated with interradicular bone loss ranging from 0.80–9.70 mm; both were significantly correlated with each other ($p<0.001$). The results obtained in our study, where the mean value of mesial interdental bone loss is 5.90±2.4 mm, and the mean value of distal interdental bone loss is 6.10±6.10 mm, are found to be associated with interradicular bone loss in the range of 3.55±5.10 mm. The correlation between mesial interdental bone loss and interradicular bone loss is moderately positive as the Pearson correlation (r) value is 0.376. The correlation between distal interdental bone loss and interradicular bone loss is strongly positive asPearson's correl

The results of this study revealed that the lowest amount of interradicular bone loss of about 0.34 mm and more was observed only when the interdental bone loss was 2.10 mm or more, which is similar to the results obtained by Popova et al.[25] who conducted a study to investigate the relationship between interradicular bone destruction and interdental bone loss in patients with chronic periodontitisand found thatbone loss in functions measuring1 mm or more was correlated with interdental bone loss above 4 mm.

In accordance with the results of this research, the research conducted by Clara S. Kim et al.[18] to determine whether teeth with affected furcations lose significantly more boneover time at the furcation site compared to the interproximal sites of the same tooth; it was shown that the change in bone level over time is on average 4.22% for interproximal sites and 4.55% for furcation sites.

The determination of interdental bone loss can be used as a screening tool to detect the disease at an early stage, especially when it is considered that the treatment of affected furcationsin an advanced stage is complex, expensive, long-term and requires an interdisciplinary approach.

Ova studija pokazala je da je interradikularni gubitak kosti povezan sa napredovanjem destrukcije kosti kod višekorenih zuba pacijenata sa hroničnom parodontopatijom imao značajnu povezanost sa gubitkom kosti u interdentalnom području. Kada je interdentalni gubitak kosti veći od 3,10 mm, istovremeno se javlja i nekoliko milimetara interradikularnog gubitka kosti, te se interdentalni gubitak kosti može smatrati približnim vodičem za otkrivanje ranih koštanih oštećenja u furkacijama kod pacijenata sa hroničnom parodontopatijom. Ovo može zaustaviti napredovanje bolesti i dovesti do poboljšane prognoze za interradikularne regije višekorenih zuba.

Zaključak

Na osnovu rezultata istraživanja može se reći da je interradikularni gubitak kosti kod višekorenih zuba osoba sa hroničnom parodontopatijom u pozitivnoj korelaciji sa mezijalnim i distalnim gubitkom interdentalne kosti. Ova korelacija sugeriše na to da lečenje interdentalne destrukcije kosti različitim modalitetima može sprečiti dalji gubitak kosti u interradikularnom području, u skladu sa dužinom korena i anatomijom same furkacije.

Buduća istraživanja treba da budu fokusirana na primenu CBCT koji koristi kalibrisanu kliničku i 3D radiografiju za utvrđivanje, između ostalog, napredovanja parodontalnog oboljenja na mestima furkacija višekorenih zuba.

Zahvalnica: Nema

Sukob interesa: Nema

This study showed that interradicular bone loss associated with the progression of bone destruction in multi-rooted teeth of patients with chronic periodontitis had a significant association with bone loss in the interdental area. When interdental bone loss is greater than 3.10 mm, several millimetres of interradicular bone loss also occurs and interdental bone loss can be considered an approximate guide for detecting early bone damage in furcationsin patients with chronic periodontitis. This can stop the progression of the disease and can lead to an improved prognosis for the interradicular regions of multi-rooted teeth.

Conclusion

Based on theresearch results, it can be said that interradicular bone loss in multi-rooted teeth of patients with chronic periodontitis is positively correlated with mesial and distal interdental bone loss. This correlation suggests that the treatment of interdental bone destruction with different modalities can prevent further bone loss in the interradicular area according to the length of the root and the anatomy of the furcation itself.

Future research should focus on the application of CBCT using calibrated clinical and 3D radiography to determine, among other things, the progression of periodontal disease at the furcation sites of multi-rooted teeth.

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