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IZVORNI ZNANSTVENI RAD
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Radiografska procjena gubitka alveolarne kosti oko zubnih implantata u maksili i mandibuli: jednogodišnje prospektivno kliničko istraživanje

Radiographic Evaluation of Crestal Bone Loss Around Dental Implants in Maxilla and Mandible: One Year Prospective Clinical Study

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Sažetak

Svrha: Godinu dana nakon ugradnje želio se analizirati gubitak alveolarne kosti u maksili i mandibuli oko implantata BREDENT Sky Blue različitih dimenzija. **Materijali i metode:** U maksilu je bilo umetnuto 36 implantata promjera 3,5 x 10 mm, a u mandibulu 12. Uz to, 52 implantata promjera 4,0 x 8 mm ugrađena su u maksilu i 61 u mandibulu (dvostupanjska implantacijska operacija). **Rezultati:** Nije bilo statističke razlike u gubitku kosti između maksile desno i lijevo te mandibule desno i lijevo na mjestima implantacije mezijalno i distalno. Rezultati su dobiveni analizom varijance (ANOVA). **Zaključak:** Statistički značajna razlika u gubitku kosti zabilježena je između maksile sprijeda i straga te mandibule sprijeda i straga na mjestima implantacije distalno i mezijalno. Rezultati su dobiveni analizom varijance (ANOVA).

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Uvod

Proces cijeljenja oko zubnih implantata sličan je fiziološkom cijeljenju koštanoga tkiva. Istraživanja titanijskih implantata pokazala su da cijeljenje ima tri faze: osteofilnu, osteoinduktivnu i osteoadaptivnu (1, 2). Uspjeh terapije može se kirurški, estetski i funkcionalno predvidjeti samo ako imamo dovoljno koštanoga i gingivnoga tkiva (3). Količina marginalne kosti tijekom prve godine može utjecati na dubinu sulkusa i okoliš jer su važni za dugotrajnost implantata (4). Radiografske analize pokazale su da je oblik mikronavoja bitan u minimiziranju gubitka marginalne kosti tijekom faza cijeljenja bez stresa i pod funkcijskim opterećenjem. Preporučuje se korištenje grube površine mikronavoja za održavanje razine marginalne kosti (5 – 8). Naime, takva površina mikronavoja vrata implantata ne samo da smanjuje gubitak marginalne kosti, nego i pomaže u ranoj biomehaničkoj adaptaciji na opterećenje u usporedbi s oblikom glatkoga vrata (8). Neki autori izvijestili su o većem gubitku kosti s konvencionalnim

Introduction

The recovery time for dental implants is similar to physiological healing of bone tissue. The studies of titanium implants have shown that the process of healing can be divided in three phases: osteophilic, osteoconductive and osteoadaptive (1, 2). The success of therapy is surgically, esthetically and functionally predictable only if there is an adequate amount of bone and gingival tissue (3). The amount of crestal bone loss during the first year may affect the sulcus depth and environment for the longevity of the implant (4).

Radiographic analyses have shown that the micro threaded design was superior at minimizing marginal bone loss during stress-free healing and under functional loading. The use of rough-surfaced micro threaded implants is recommended to maintain crestal bone levels (5-8). A rough surface and micro threads at the implant neck not only reduce crestal bone loss but also help with early biomechanical adaptation against loading compared to the machined neck de-

platformama negoli s onima izmjenjivima (9 –14). To se još više ističe u slučaju nepodudaranja implantata i abatmenta (14). Kirurški zahvati za postavljanje implantata u stražnjim područjima gornje i donje čeljusti nisu teški ako imamo zadovoljavajuću količinu kosti alveolarnog nastavka. U slučaju alveolarne atrofije anatomska ograničenja, poput maksilarnih sinusa i *nervusa alveolarisa inferiora,* čine situaciju problematičnom i treba je rješavati različitim tehnikama nasađivanja. Zahvaljujući današnjim tehnikama uspješno se može riješiti većina slučajeva (15). Prema Sbordoneu i suradnicima, korištenje zrnatog presatka iz donje čeljusti pri postupku dizanja dna sinusa ne daje optimalne rezultate. Brušeni komadi kriste ilijake i brade imaju tendenciju remodeliranja oko vršaka implantata, što rezultira urastanjem unutar sinusa. Presađivanje u sinuse koštanih blokova iz brade ili kriste ilijake najuspješnije je pri ugradnji implantata u stabilno dno sinusa (16). Kad je riječ o remodeliranju augmentiranih dijelova sinusa, ponašanje autologne kosti iz kriste ilijake i ksenogenih materijala bilo je dosta slično oko apeksa implantata, a čak je i resorpcija goveđega koštanog materijala bila sporija od autogenog presatka. Ponašanje autologne kosti s brade slično je ponašanju ksenogenoga materijala, vjerojatno zbog debeloga kortikalnog sastava takvih presadaka. Razlike između imedijatnog i odgođenog postupka implantacije na razinu marginalne kosti, gdje je manja resorpcija kod imedijatne nego odgođene implantacije, pokazale su manju resorpciju kod imedijatnih postupaka (17).

Postupak kratkoročnog podizanja dna sinusa s pomoću suhe smrznute alogene kosti pokazuje slične rezultate kao i s pomoću autologne kosti. Podizanje dna maksilarnog sinusa suhom kosti alogenoga materijala u blokovima, može se razmatrati kao mogućnost u slučaju da je debljina dna čak manja od 3 mm (18). Kliničari koji planiraju fiksnoprotetske radove na implantatima postavljenima u maksilarni sinus s volumnom augmentacijom kosti ili bez nje, trebali bi razmišljati o negativnom remodeliranju koje se događa pri upotrebi autogenoga zrnatog materijala, kako u apikalnom tako i marginalnom dijelu implantata. Implantati postavljeni u prirodna područja ispod sinusa nisu pokazivali tu pojavu i postupak izgleda mnogo pouzdaniji, ali je njihovo preživljavanje slično onima postavljenima u augmentirana mjesta (19).

Imedijatno postavljanje u prednjem području i dalje je najčešća indikacija, posebice kada se radi o implantatima. Raspoloživa kost varira o stupnju atrofije. Postavljanje implantata u stražnju zonu češće je jednostrano kako bi se izbjegla djelomična proteza, ili bilateralno nakon dugogodišnje bezubosti (20). U maksili, uvjetno pogodnom mjestu za postavljanje implantata, prednji je dio alveolarnog grebena do područja drugog pretkutnjaka. Nepovoljno područje je stražnji dio maksile, uključujući tuber maksile (21). Kada se postavljaju implantati u prednje područje maksile, pozornost treba posvetiti estetici protetskoga nadomjestka (20). Kod nadomještanja prednjih zuba implantatima čest je problem nedostatak kosti u vestibulo-oralnoj dimenziji (3).

Svrha ovog istraživanja bila je procijeniti resorpciju marginalne kosti oko zubnih implantata u različitim područjima maksile i mandibule godinu dana nakon funkcionalnog opterećenja.

sign (8). Some authors have reported greater marginal bone loss with conventional platforms than with platform switching (9-14). This appeared more evident with increasing the extent of implant-abutment mismatching (14).

Implant surgery in posterior regions of upper and lower jaws is not difficult in cases with a satisfactory bone volume of the alveolar process. However, in cases of alveolar atrophy the anatomical limitations with the maxillary sinus cavity and the alveolar nerve canal, the situation becomes more problematic and has to be solved by using different kinds of graft techniques. However, most cases can be successfully solved with the techniques that are available today. (15). According to Sbordone et al, the use of particulate chin bone grafts in sinus lift procedures does not seem to yield optimal outcomes. Milled iliac crest and chin bone tends to remodel around the implant apices, leading to bulging within the sinuses. Grafting sinuses with either chin or iliac crest bone blocks yields the highest implant success rates and stable sinus floors (16). Regarding remodeling in augmented sinus areas, the behavior of the autologous bone from the iliac crest and the xenogenic material was ultimately very similar at the implant apex, even though for bovine bone material the resorption was much slower than that of the autogenous graft. The behavior of autologous bone from the chin seemed similar to that of xenogenic material, probably because of the dense cortical composition of such grafts. The differences between immediate and delayed procedures of implantation, with regard to marginal bone, showed a lesser resorption process of the former as compared with the latter (17).

The short-term sinus grafting procedure for dental implant placement performed with freeze-dried allogeneic bone showed an outcome close to that reported for autogenous bone. Performing maxillary sinus augmentation with dry-preserved bone allogeneic materials in block form could be considered even when the residual floor thickness is less than 3 mm (18). Clinicians who plan a fixed prosthesis supported by dental implants placed in the maxillary sinus, with or without bone volume augmentation, should consider the negative remodeling encountered in the autogenous particulate materials, both in the apical and marginal peri-implant aspects. Implants placed in native areas beneath the sinus did not exhibit such behavior; therefore, the procedure seems to be more reliable. Nevertheless, the survival of these implants is quite similar to those placed in augmented areas (19).

Implant placement in the anterior region of the mandible is still the most common indication, especially when using four implants. The bone availability varies depending on the degree of atrophy. Implant placement in the posterior mandible is more often unilaterally in order to avoid a partial denture, or bilaterally after long periods of edentulousness (20). At the maxilla, the front part of alveolar crest to the second premolar is conditionally favorable region for implantation. An unfavorable region for implantation is the posterior maxilla, including the maxillary tuberosity (21). When installing implants in front region of the maxilla the greatest attention should be paid to the esthetics of the prosthesis (20). Insufficient bone in vestibular-oral dimension is a common problem in treating missing front teeth with implants (3).

Materijali i metode

Istraživanje je odobrilo Povjerenstvo za etiku Stomatološkog fakulteta u Sarajevu. Svi sudionici potpisali su informiranu suglasnost, a istraživanje je provedeno na Katedri za protetiku Stomatološkog fakulteta u Sarajevu od siječnja 2010. do prosinca 2013. Kriteriji su bili dob > 18 godina, oba spola, pacijenti bez kontraindikacija za postavljanje implantata, bez indikacije za augmentaciju kosti, potpuno bezubi ili djelomično bezubi, dovoljna visina alveolarne kosti za postavljanje zubnih implantata promjera 3,5 x 10 mm i 4,0 x 8 mm, te oni koji su potpisali informiranu suglasnost.

Isključni kriteriji bili su bolesti oralnih mekih tkiva, bolesti ili defekti maksile i mandibule, loša oralna higijena, konzumacija alkohola, ovisnost o drogama, sustavne bolesti koje utječu na metabolizam kostiju i oralne sluznice te bilo koji razlog za nemogućnost postavljanja implantata prema uputama proizvođača. Četrdeset i dva pacijenta – 23 muškarca i 19 žena bilo je uključeno u ovo istraživanje. Srednja dob iznosila je 56 godina – u rasponu od 18 do 81 godine. Među pacijentima je 78,3 posto bilo djelomično ozubljeno, a 21,7 posto bilo je bezubo. Među pacijenticama bilo je 94,7 posto djelomično ozubljenih, a 5,3 posto bilo je bezubo. Postavljen je ukupno 161 implantat Bredent blueSKY® prema dvoposjetnom kirurškom protokolu. Trideset i šest implantata promjera 3,5 x 10 mm ugrađeno je u maksilu, a 12 u mandibulu. Postavljena su također 52 implantata promjera 4,0 x 8 mm u maksilu i 61 u mandibulu. Implantati su postavljeni prema strogim kirurškim protokolima proizvođača. Nakon svrdla Sky Pilot, za određivanje dubine postavljanja implantata, korišteno je svrdlo Twist-Drill. Dubina izbušene rupe bila je veća oko 0,5 mm od dužine implantata. Pripremljena je cilindrična jezgra implantata, ovisno o kvaliteti kosti, s pomoću D3 – 4 za meke i srednje tvrde kosti te D1 – 2 za tvrde kosti. Dubina izbušene kosti duža 0,5 mm od implantata, podvrgnuta je konično cilindričnoj obradi koronarnog dijela. Dubina izbušene rupe je za 0,5 mm premašivala implantat. Nakon tromjesečne faze cijeljenja bez funkcijskog opterećenja, postavljen je tzv. *gingiva former*. Uklonjen je nakon 14 dana kada su uzeti otisci. Protetska suprastruktura postavljena je četiri mjeseca nakon kirurškoga zahvata. Svi implantati korišteni su kao bataljci za individualne krunice i mostove. Panoramski radiogram učinjen je prije kirurškoga zahvata, neposredno poslije njega i 12 mjeseci nakon funkcijskog opterećenja s pomoću uređaja Ortopantomograph type Kodak 8000 c XJAM530. Panoramske snimke kalibrirane su CliniViewom (version 5,2 Instrumentarium Imaging). Mjerenja su obavljena programskim paketom Kodak dental software 6.11.7.0. Resorpcija marginalne kosti mjerena je mezijalno i distalno za svaki implantat od koronarnoga dijela abatmenta do mjerljivoga ruba alveolarne kosti, neposredno nakon postavljanja implantata (točka A) i godinu dana nakon funkcionalnog opterećenja (točka B). Razlika među izmjerenim vrijednostima smatrala se gubitkom marginalne kosti.

The aim of this study was to evaluate crestal bone resorption around dental implants in different regions of maxilla and mandible after one year of functional loading.

Materials and methods

This study has been approved by the Ethics Committee of the School of Dentistry Sarajevo (University of Sarajevo). All the subjects gave their informed consent.

This study was conducted at the Department of Prosthodontics, School of Dentistry Sarajevo (University of Sarajevo), from January 2010 to December 2013.

Inclusion selection criteria were: age > 18 years; both sexes; patients without contraindications for implant placement; patients who gave their informed consent to participate in the study; patients without indications for bone augmentation; completely edentulous or partially dentate patients; sufficient height of the alveolar bone for placement of dental implants of diameter 3.5 x 10 mm and 4.0 x 8 mm.

Exclusion selection criteria were: disease of oral soft tissue; disease and defects of the maxilla and mandible; poor oral hygiene; alcohol consumption; drug addiction; systemic diseases which affect bone metabolism and oral mucosa and impossibility of dental implant placement according the manufacturer's instructions for any reason.

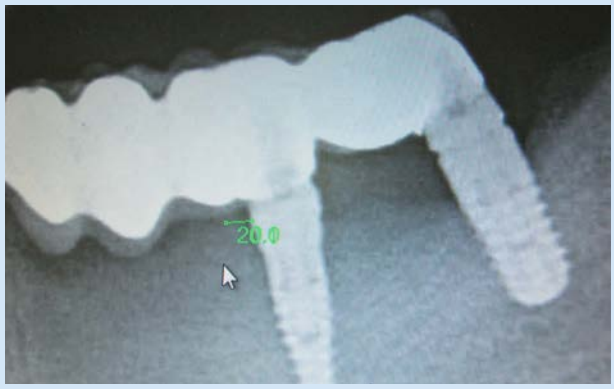
Forty two patients, 23 males and 19 females, were included in this study. The mean age of patients was 56, ranging in age from 18 to 81 years. Among male patients, 78.3% were partially dentate, while 21.7% were totally edentulous. 94.7% females were partially dentate, only 5.3% were totally edentulous.

A total of 161 implants type Bredent blueSKY® were inserted according to a two-stage surgical protocol. Thirty six implants of diameter 3.5 x 10 mm were inserted in the maxilla and 12 in the mandible. Fifty two implants of diameter 4.0 x 8 mm were inserted in the maxilla and 61 in the mandible. The implants were placed into the mandible and maxilla according to a strict surgical protocol following the manufacturer's instructions.

After using SKY pilot drill, the Twist-Drill was used to determine depth and direction of the implant. The depth of the drilled hole exceeds the implant length by approx. 0.5 mm. The cylindrical core of the implant was prepared, depending on the bone quality, with the D3-4 for soft and medium hard bones, and with D1-2 drills for hard bone. The depth of the drilled hole exceeded the implant length by approx. 0.5 mm. Finally, the conic-cylindrical preparation of the coronal cavity took place. After healing phase of three months without functional loading, a gingiva former was inserted. After 14 days, the gingiva former was removed and impressions were taken. The time placement of prosthetic restorations on the implants was four months after surgery. All the implants were used as abutments of individual crowns and bridges.

Dental panoramic radiographs were made before surgery, immediately after surgery and after 12 months of functional loading, using Ortopantomograph type Kodak 8000 c, XJAM530. Panoramic images were calibrated using Clini-

Slika 1. Marginalni rub kosti odmah nakon postavljanja implantata u mandibulu
Figure 1 Detectable margin of the alveolar bone immediately after implant placement in mandible



Slika 2. Mjerenje gubitka marginalne kosti (mezijalno) nakon jednogodišnjega funkcionalnog opterećenja
Figure 2 Measurement of crestal bone loss (mesially) after a year of functional loading

Statistička analiza

Dobiveni podatci analizirani su softverskim paketom IBM SPSS v.17 (deskriptivna statistika, ANOVA test).

Rezultati

Tablica 1.: Opis pacijenata ovisno o spolu i navikama pušenja

View (version 5.2 Instrumentation Imaging). The measurements were performed using software Kodak dental software 6.11.7.0.

Crestal bone resorption was measured mesially and distally for each implant from the coronal portion of the abutment to the detectable margin of the alveolar bone, immediately after implant placement (point A) and after a year of functional loading (point B).

Statistical analysis

The data were analyzed using the IBM SPSS v.17 software package (descriptive statistics, ANOVA -test).

Results

Table 1 shows a description of patients regarding gender and smoking habits.

Tablica 1. Raspodjela pacijenata ovisno o spolu i navici pušenja
Table 1 Distribution of patients patients regarding gender and smoking habits

		Spol • Gender					
		Muški • Male		Ženski • Female		Ukupno • Total	
		n	%	n	%	n	%
Navika pušenja • Smoking habits	Pušači • Smokers	10	43.5	8	42.1	18	42.9
	Nepušači • Non-smokers	13	56.5	11	57.9	24	57.1
Ukupno • Total		23	100	19	100	42	100

Tablica 2: Postavljeni implantati u prednjem i stražnjem području mandibule i maksile, odvojeno na desnoj i lijevoj strani.

Tablica 2.: Ni za jedan promjer implantata nije pronađena statistički značajna razlika u distalnim i mezijalnim gubitcima marginalne kosti na mjestima na kojima su postavljeni (prikazano u tablicama 3. i 4.).

Tablica 5.: Statistički značajna razlika u aritmetičkim sredinama marginalne kosti oko zubnih implantata promjera 3,5 mm postavljenih u prednje i stražnje maksilarno polje te prednje i stražnje mandibularno polje. Statistički značajna razlika zabilježena je između prednjeg i stražnjeg maksilarnog

Table 2 shows the frequency of inserted implants in the anterior and posterior region of the mandible and maxilla on the right and left side.

No statistically significant differences in distal as well as in mesial bone losses were found between implant sites on left and right sides of both jaws, for both implant diameters, as reported in Tables 3 and 4.

Table 5 shows statistically significant differences in mean crestal bone loss around dental implants with diameter of 3.5 mm between maxilla front, maxilla posterior, mandible front and mandible posterior. Statistically significant differences were found between maxilla front, maxilla posterior,

Tablica 2. Učestalost postavljenih implantata u regiji maksile i mandibule
Table 2 Frequency of inserted implant by region of maxilla and mandible

		Promjer implantata • Diameter of implant					
		3.5 x 10 mm		4.0 x 8 mm		Total	
		n	%	n	%	n	%
Regija • Region	Maksila desno sprijeda • Maxilla right front	12	25.0	0	0.0	12	7.5
	Maksila lijevo sprijeda • Maxilla left front	13	27.1	0	0.0	13	8.1
	Maksila desno straga • Maxilla right posterior	6	12.5	22	19.5	28	17.4
	Maksila lijevo straga • Maxilla left posterior	5	10.4	30	26.5	35	21.7
	Mandibula lijevo sprijeda • Mandible left front	4	8.3	0	0.0	4	2.5
	Mandibula desno sprijeda • Mandible right front	3	6.3	1	0.9	4	2.5
	Mandibula lijevo straga • Mandible left posterior	4	8.3	28	24.8	32	19.9
	Mandibula desno straga • Mandible right posterior	1	2.1	32	28.3	33	20.5
Ukupno • Total		48	100	113	100	161	100

Tablica 3. Gubitak marginalne kosti 12 mjeseci nakon funkcionalnog opterećenja za implantat promjera 3,5 x 10 mm
Table 3 Marginal bone loss after 12 months of functional loading for implant diameter of 3.5x10 mm

Promjer implantata • Diameter of implant 3.5 x 10 mm		n	Arit. sred. • Mean	Std. devijacija • Std. Deviation	F	p*
Distalna resorpcija • Distal resorption (mm)	Maksila desno • Maxilla right	18	0.60	0.32	0.749	0.529
	Maksila lijevo • Maxilla left	18	0.62	0.28		
	Mandibula desno • Mandible right	4	0.85	0.24		
	Mandibula lijevo • Mandible left	8	0.68	0.40		
Mezijalna resorpcija • Mesial resorption (mm)	Maksila desno • Maxilla right	18	0.50	0.36	2.191	0.102
	Maksila lijevo • Maxilla left	18	0.59	0.29		
	Mandibula desno • Mandible right	4	0.88	0.30		
	Mandibula lijevo • Mandible left	8	0.77	0.36		

* Analiza varijance (ANOVA) • Analysis of variance (ANOVA)

Tablica 4. Gubitak marginalne kosti 12 mjeseci nakon funkcionalnog opterećenja za implantat promjera 4,0 x 8 mm
Table 4 Marginal bone loss after 12 months of functional loading for implant diameter of 4.0 x 8 mm

Promjer implantata • Diameter of implant 4.0 x 8 mm		n	Arit.sred. • Mean	Std. devijacija • Std. Deviation	F	p*
Distalna resorpcija • Distal resorption (mm)	Maksila desno • Maxilla right	22	0.52	0.41	0.485	0.693
	Maksila lijevo • Maxilla left	30	0.60	0.44		
	Mandibula desno • Mandible right	33	0.49	0.40		
	Mandibula lijevo • Mandible left	28	0.50	0.36		
Mezijalna resorpcija • Mesial resorption (mm)	Maksila desno • Maxilla right	22	0.53	0.40	0.128	0.943
	Maksila lijevo • Maxilla left	30	0.54	0.39		
	Mandibula desno • Mandible right	33	0.58	0.35		
	Mandibula lijevo • Mandible left	28	0.54	0.36		

* Analiza varijance (ANOVA) • Analysis of variance (ANOVA)

Tablica 5. Gubitak marginalne kosti 12 mjeseci nakon funkcionalnog opterećenja za implantate promjera 3,5 x 10 mm u različitim regijama maksile i mandibule
Table 5 Marginal bone loss after 12 months of functional loading for implant of diameter 3.5x10 mm in different region of maxilla and mandible

Promjer implantata • Diameter of implant 3.5 x 10 mm		n	Arit.sred. • Mean	Stand. devijacija • Std. Deviation	F	p*
Distalna resorpcija • Distal resorption (mm)	Maksila sprijeda • Maxilla front	25	0.67	0.26	4.083	0.012
	Maksila straga • Maxilla posterior	11	0.47	0.34		
	Mandibula sprijeda • Mandible front	7	0.91	0.22		
	Mandibula straga • Mandible posterior	5	0.48	0.37		
Mezijalna resorpcija • Mesial resorption (mm)	Maksila sprijeda • Maxilla front	25	0.57	0.32	3.411	0.026
	Maksila straga • Maxilla posterior	11	0.49	0.35		
	Mandibula sprijeda • Mandible front	7	0.96	0.21		
	Mandibula straga • Mandible posterior	5	0.60	0.37		

* Analiza varijance (ANOVA) • Analysis of variance (ANOVA)

polja te prednjeg i stražnjeg mandibularnog polja na mjestima postavljanja implantata, kad je riječ o resorpciji distalne i mezijalne marginalne kosti. Razlika je prikazana analizom varijance (ANOVA). Najveća aritmetička sredina koštane resorpcije zabilježena je u prednjem polju mandibule na distalnom dijelu implantata (M = 0,91) te u prednjem polju mandibule na mezijalnoj strani (M = 0,96).

(Tablica 5.) Aritmetičke sredine mezijalne i distalne resorpcije oko implantata promjera 4,0 x 8 mm između prednjeg i stražnjeg područja mandibule i bočnog područja maksile testirane su ANOVA-om. Prednje područje mandibule nije uključeno zbog nedovoljnog broja slučajeva (n = 1).

Tablica 6.: Aritmetičke sredine gubitka marginalne kosti oko zubnih implantata različitih promjera; prema studentskom t-testu nije nađena značajna razlika oko implantata različitih promjera i gubitka marginalne kosti.

mandible front and mandible posterior at implant sites regarding distal and mesial bone losses as shown by analysis of variance (ANOVA).

The highest mean of bone resorption was measured in mandible front distally (M = 0.91), and the mandible front mesially (M = 0.96).

The mean of distal and mesial resorption at implant diameter of 4.0 x 8 mm between regions of the mandible front, mandible lateral and the maxilla lateral were not tested by ANOVA due to insufficient number of cases in the mandible front (n = 1).

Table 6 shows the differences in mean crestal bone loss around dental implants with different diameters. Student's t-test showed no statistically significant differences in marginal bone loss.

Tablica 6. Aritmetička sredina i standardna devijacija gubitka marginalne kosti ovisno o različitim promjerima implantata
Table 6 The mean and standard deviation of marginal bone loss dependent on different implant diameter

Varijabla • Variable	Promjer implantata • Diameter of implant						
	3.5 x 10 mm (n=48)		4.0 x 8 mm (n=113)				
	95% C.I. for Arit.sred. • Mean	Std. Devijacija • Std. Deviation	95% C.I. for Arit.sred. • Mean	Std. Devijacija • Std. Deviation	t	df	p
Distalna resorpcija • Distal resorption (mm)	0.642±0.07	0.311	0,529±0.078	0.401	1.92	113.15	0.057
Mezijalna resorpcija • Mesial resorption (mm)	0.612±0.09	0.342	0,551±0.059	0.370	0.98	159	0.331

Rasprava

Gubitak marginalne kosti procjenjivan je radiografski i neposredno je povezan s dugoročnim uspjehom terapije implantatima (22). Najčešće promatrani gubitak kosti na mezijalnoj ili distalnoj strani smatra se konačnim gubitkom kosti oko implantata (23). Prema Albrektssonu i suradnicima, promjena u razini marginalne kosti u prvoj godini nakon postavljanja implantata trebala bi biti manja od 1 do 1,5 mm, a nastavak godišnje resorpcije trebao bi iznositi manje od 0,2 mm (24). Prema nekim istraživačima, kritične vrijednosti gubitka kosti godinu dana nakon postavljanja implantata, prema preporukama manje su od 1,5 mm, sa srednjim vrijednostima idućih godišnjih gubitaka od oko 0,1 mm (25 – 27). U ovom istraživanju izmjerena je aritmetička sredina mezijalnoga i distalnoga gubitka kosti oko implantata manja od navedenih kritičnih vrijednosti, što se može smatrati uspjehom.

Rasouli Ghahroudi i suradnici (22) ustanovili su značajnu razliku između gubitka kosti mezijalno i distalno od mandibularnih i maksilarnih implantata, ili maksimalni gubitak kosti na ovim mjestima između gornjih i donjih implantata. Godinu dana nakon opterećivanja, aritmetička sredina gubitka distalne kosti bila je kod mandibularnih implantata 0,759 mm (standardna pogreška: 0,088), a maksilarnih 0,615 mm (SG: 0,097). Srednja vrijednost gubitka mezijalne kosti iznosila je kod mandibularnih implantata 0,701 mm (SE: 0,088), a kod maksilarnih 0,627 mm (SE: 0,097) (22). Hobo i suradnici (28) izvijestili su o srednjoj vrijednosti gubitka kosti od 1 do 1,5 mm u prvoj godini nakon postavlja-

Discussion

Marginal bone loss is evaluated by means of radiography and is directly associated with the long-term success of implant treatments (22). The most observed loss occurring in mesial or distal sides is considered as the final implant bone loss (23). According to Albrektsson et al, marginal bone level changes in the first year after implant insertion should be less than 1-1.5 mm and the ongoing annual bone loss should be less than 0.2 mm (24). According to some other authors, the critical values of bone loss following one year after implantation have been proposed to be less than 1.5 mm with the mean 0.1 mm annual rate in the following years (25-27). In this study, the measured mean mesial and distal bone loss of the implants was less than the mentioned critical value, be considered a success.

Rasouli Ghahroudi et al. (22) found no significant differences regarding bone loss occurring at the distal and mesial sides of the mandibular and maxillary implants or the maximum bone loss, taking place at these sides between the upper and lower implants. After 1-year loading the mean distal bone loss of mandibular and maxillary implants were 0.759 mm (standard error: 0.088) and 0.615 mm (SE: 0.097), and the mean mesial bone loss of mandibular and maxillary implants was also 0.701 mm (SE: 0.088) and 0.627 mm (SE: 0.097), respectively (22). Hobo et al (28) reported the mean bone loss of 1-1.5 mm for the first year of implant placement. Johansson and Ekfeldt (29) showed a mean bone loss amounting to 0.4 mm at the first year. Jang et al. (30) found

nja implantata. Johansson i Ekfeldt (29) izmjerili su tijekom prve godine gubitak kosti od 0,4 mm. Jang i suradnici (30) ustanovili su prosječan gubitak kosti od 0,7 mm nakon prve godine. Mezijalno je gubitak kosti bio od 0,4 do 1,2 mm, a distalno od 0,3 mm do 1,3 mm (30). Hürzeler i suradnici (31) ustanovili su tijekom prve godine gubitak kosti od 0,40 mm (± 0,12 mm).

Mnogo čimbenika utječe na prognozu implantata i mogu pridonijeti neuspjehu. To su dužina, oblik, površina i promjer implantata, mjesto postavljanja, kvaliteta kosti, opće zdravlje pacijenta i funkcionalno opterećenje (5 – 4, 32 – 37). U našem istraživanju nisu sudjelovali pacijenti sa sustavnim bolestima i prognoza implantata temeljila se na različitim promjerima. Izmjerena srednja razina resorpcije oko zubnih implantata promjera 4,0 x 8 mm bila je manja nego oko onih od 3,5 x 10 mm, ali razlika nije bila statistički značajna. Karoussis i suradnici (35) procijenili su i usporedili 10-godišnje preživljavanje i stope komplikacija u korištenju ITI implantata (AHC)® Dental Implants sa šupljim navojem, šupljim cilindrom i anguliranim šupljim cilindrom. Komplikacije su se pojavile kod 10 posto implantata sa šupljim navojem, a periimplantitis je kod upotrebe implantata sa šupljim cilindrom bio gotovo tri puta viši (29 %). Anguli rani implantati šupljeg cilindra imali su 12 posto komplikacija. Danza i suradnici (37) istaknuli su da je razina očuvanja marginalne kosti oko konvencionalnih i imedijatno opterećenih implantata s modificiranim promjerom bila slična, s blagom značajnom razlikom u mandibuli gdje je zabilježen manji gubitak marginalne kosti.

U ovom istraživanju nismo pronašli značajnu razliku u gubitku kosti između maksilarnih i mandibularnih implantata, ovisno o mjestu postavljanja. Ovi podatci slažu se s rezultatima nekih istraživanja (22, 38, 39). Suprotno tome, Penarrocha i suradnici (40) te Pham i njegovi kolege (41) izvijestili su o većem gubitku kosti kod upotrebe maksilarnih implantata negoli kod mandibularnih. Naši rezultati pokazali su veću resorpciju kosti kod prednjih implantata u usporedbi sa stražnjima, što je suprotno od rezultata Boronata i suradnika. (23). Pojedini istraživači nisu našli značajnu razliku između implantata postavljenih u prednja i stražnja područja (22, 42).

Zaključak

Procjena gubitka marginalne kosti prijeko je potrebna za procjenu uspješnosti postavljanja implantata. Rezultati ovog istraživanja pokazali su veće gubitke marginalne kosti kod implantata postavljenih u prednja područja u odnosu na one u stražnjima, ali nije bilo statistički značajne razlike između maksilarnih i mandibularnih mjesta implantacije godinu dana nakon njihova funkcionalnog opterećenja.

Sukob interesa

Ne postoji.

bone loss of 0.7 mm after the first year. Mesial crestal resorption ranged from 0.4 mm to 1.2 mm and distal crestal resorption ranged from 0.3 mm to 1.3 mm (30). Hürzeler et al. (31) found bone loss of 0.40 mm (± 0.12 mm) within one year.

Several factors influence implant prognosis and can attribute to implant failure: length and diameter of the implant, implant location, implant designs, bone quality, implant surface and the general health of the patient, functional loading (5-14, 32-37). In the present study, the patients with systemic diseases have been excluded and implant prognosis was based on the different implant diameters. The mean marginal bone loss which was measured around dental implants of diameter 4.0 x 8 mm was less than around dental implants of diameter 3.5 x 10 mm, but the differences between these groups were not statistically significant.

Karoussis et al. (35) evaluated and compared the 10-year survival and complication rates of hollow screw, hollow cylinder and angulated hollow cylinder (AHC) ITI® Dental Implants. Complications occurred at 10% of hollow screw implants, while at hollow cylinder implants, the prevalence of peri-implantitis in 10 years was almost three times higher (29%). Angulated hollow cylinder implants presented a complication rate of 12%. Danza et al. (37) reported that crestal bone maintenance around conventionally and immediately loaded modified diameter implants was similar, with slight significant differences in mandible where a lower marginal bone loss was observed.

In this study, we found no significant different bone loss between maxillary and mandibular implants regarding sites. This finding is in agreement with the results obtained in some studies (22, 38, and 39). On the contrary, Penarrocha et al (40) and Pham et al. (41) showed more bone loss for maxillary implants compared to mandibular implants.

This study showed more bone loss for anterior implants compared to the posterior ones, which is contrary to the results of Boronat et al. (23). Some authors found no significant differences regarding implants placed at anterior and posterior regions (22, 42).

Conclusion

The assessment of crestal bone loss around implants is necessary for evaluating implant success. This study showed more crestal bone loss for anterior implants compared to the posterior ones, but there was no significantly different crestal bone loss between maxillary and mandibular implants regarding sites, after one year of functional loading.

Conflict of interest

The authors declare that there are no conflicts of interest.

Abstract

Purpose: The aim of the study was to analyze the amount of maxillary and mandibular crestal bone loss around Bredent Sky Blue type of implants of different dimensions one year after implantation. **Materials and Methods**: 36 implants of diameter 3.5 x 10 mm were inserted in the maxilla and 12 in the mandible. 52 implants of diameter 4.0 x 8 mm were inserted in the maxilla, and 61 in the mandible (two-stage implant surgery). **Results:** No statistically significant differences were found between the right and left side of the maxilla and between the right and left side of the mandible at the implant sites regarding distal and mesial bone losses as shown by analysis of variance (ANOVA). **Conclusion:** Statistically significant differences were found between anterior maxilla, posterior maxilla and anterior mandible and posterior mandible at implant sites regarding distal and mesial bone losses as shown by analysis of variance (ANOVA).

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Key words
Alveolar Bone Loss; Bone Resorption; Dental Implants; Maxilla; Mandible

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