ACTA
STOMATOLOGICA
CROATICA
www.ascro.hr

Acta stomatol Croat. 2018;52(3):184-192.
DOI: 10.15644/asc52/3/2

IZVORNI ZNANSTVENI RAD
ORIGINAL SCIENTIFIC PAPER

Visar Disha[1], Asja Čelebić[2], Ksenija Rener-Sitar[3], Ines Kovačić[2], Irina Filipović Zore[4], Sanja Peršić[2]

Djelomične proteze retinirane mini dentalnim implantatima: veličina učinka terapije i praćenje tijekom šest mjeseci

Mini Dental Implant-Retained Removable Partial Dentures: Treatment Effect Size and 6-Months Follow-up

[1] Privatna stomatološka ordinacija, Priština, Kosovo
Private Dental office, Priština, Republic of Kosovo
[2] Zavod za stomatološku protetiku Stomatološkog fakulteta u Zagrebu, Hrvatska
Department of Prosthodontics, School of Dental Medicine, University of Zagreb, Croatia
[3] Studij stomatologije na Medicinskom fakultetu u Ljubljani, Slovenija
School of Medicine, Study of Dentistry, University of Ljubljana, Slovenia
[4] Zavod za oralnu kirurgiju Stomatološkog fakulteta u Zagrebu, Hrvatska
Department of Oral Surgery, School of Dental Medicine, University of Zagreb, Croatia

Sažetak

Svrha: Željela se usporediti estetika, žvačna funkcija i udobnost nošenja djelomičnih proteza retiniranih kvačicama (konvencionalne; C-DP) i djelomičnih proteza retiniranih minidentalnim implantatima (MDI-DP) u mandibuli, nakon predaje novih djelomičnih proteza pacijentima. **Materijali i metode:** U istraživanju je sudjelovalo ukupno 88 pacijenata (Kennedyjeve klase I) s gubitkom zuba u posteriornoj regiji i djelomičnim protezama koje bi inače na preostalim zubima bile linearno poduprte. U skupini C-DP (konvencionalne djelomične proteze retinirane kvačicama) sudjelovala su 52 pacijenta (36 žena i 16 muškaraca u dobi od 56 do 84 godine), a u skupini MDI-DP (djelomične proteze retinirane minidentalnim implantatima) bilo je 36 pacijenata (26 žena i 10 muškaraca u dobi od 43 do 81 godine). Svi minidentalni implantati (MDI) bili su postavljeni na strateške pozicije, distalnije od posljednjeg zuba u zubnom nizu i to odmah pokraj zadnjega ili otprilike za širinu jednog zuba distalnije od posljednjega zuba. Djelomične proteze bile su izrađene od legure kobalt-kroma s jezično postavljenom velikom spojkom. U skupini MDI-DP djelomične su proteze bile retinirane na minidentalnim implantatima s pomoću kuglaste kapice (O-ringa), a konvencionalne djelomične proteze bile su retinirane kvačicama. Svi pacijenti nekoliko su puta odgovorili na određena pitanja – prije terapije, poslije terapije i adaptacije na nove proteze te šest mjeseci poslije. Odgovarali su na pitanja koja se odnose na zadovoljstvo estetskim izgledom, na sigurnost pri žvakanju krute hrane te koliko su zadovoljni mogućnošću usitnjavanja hrane. Također su ocijenili ugodnost nošenja djelomične proteze. Primijenila se vizualno-analogna ljestvica od 0 do 10. Statistička analiza uključivala je deskriptivne metode, t-testove i standardizirani izračun veličine učinka terapije. **Rezultati:** Pacijenti u skupini MDI-DP bili su zadovoljniji estetikom, usitnjavanjem hrane, udobnošću pri nošenju djelomične proteze i bili su sigurniji pri žvakanju poslije terapije u odnosu prema pacijentima s djelomičnim protezama retiniranima kvačicama. U skupini MDI-DP također je utvrđen veći učinak terapije. Rezultati su ostali konzistentni tijekom prvih šest mjeseci praćenja. **Zaključak:** Pacijenti u skupini MDI-DP pokazali su bolje rezultate u odnosu prema onima u skupini C-DP nakon terapije i tijekom šestomjesečnog praćenja.

Zaprimljen: 28. svibnja 2018.
Prihvaćen: 20. kolovoza 2018.

Adresa za dopisivanje
Prof. dr. sc. Asja Čelebić
Sveučilište u Zagrebu
Stomatološki fakultet
Zavod za mobilnu protetiku
Gundulićeva 5, 10000 Zagreb
Hrvatska
tel.: 01/4802-111
celebic@sfzg.hr

Ključne riječi
djelomična mobilna zubna proteza; zadržavanje zubne proteze; kvačice za zube; zubni implantati; dentalna estetika; žvakanje

Uvod

Terapija za većinu djelomično ozubljenih osoba bez zuba u posteriornoj regiji jest izrada djelomičnih mobilnih proteza (DP). Važno je razumjeti načine prijenosa i raspodjele opterećenja kad je riječ o različitim dizajnima djelomičnih proteza (1 – 5). Mogućnosti terapije osoba s gubitkom zuba u posteriornoj regiji (Kennedyjeva klasa I) su različite. Mogu se izraditi:

a. djelomične proteze (DP) retinirane kvačicama ili nekim drugim retencijskim elementima kao što su kopče

Introduction

Patients without all posterior teeth are mostly treated with removable partial dentures (RPDs). It is important to understand the load transfer characteristics of various RPD designs (1-5). Treatment possibilities for the mandibular Kennedy Class (6) patients without all posterior teeth include different options:

a. clasp retained RPDs (C-RPDs), precision/semi-precision attachment-retained RPDs (A-RPDs)
b. implant retained RPD (IR-RPD)

www.ascro.hr

b. djelomične proteze retinirane implantatima
c. djelomične proteze poduprte implantatima u stražnjoj regiji
d. fiksni most na implantatima.

Rehabilitacija pacijenata s pomoću djelomične proteze retinirane preciznim retencijskim elementima (kopča ili pričvrstak) obično zahtijeva pripremu prednjih zuba i izradu fiksne konstrukcije s ugrađenim kopčama prije izrade djelomične proteze tako da je potrebno brusiti retencijske prednje zube.

Oseointegrirani implantati mogu se uključiti u oblikovanje/izradu djelomične proteze u nastojanju da se umanje štetni učinci sila na samu protezu i na uporišne zube. Najčešće se implantati standardne veličine (širi od 3,5 mm, dugački 10 mm ili dulji) ugrađuju u području molara (7, 8). Djelomične proteze koje su samo poduprte implantatima imaju postavljenu nadogradnju za cijeljenje (gingivaformer) u distalnoj regiji na implantatu i pružaju djelomičnoj protezi samo potporu te tako smanjuju slijeganje proteze distalno (9, 10). Djelomične proteze koje su retinirane na implantatima vežu se raznim retencijskim elementima za implantate te na taj način osiguravaju i retenciju, ali i potporu djelomičnim protezama (7, 8, 11). U literaturi je zabilježeno da su pacijenti bili zadovoljniji djelomičnim protezama retiniranima na implantatima (12) u odnosu prema djelomičnim protezama samo *pomognutima* implantatima, ali je također zabilježena i veća stopa neuspjeha samih implantata i više tehničkih poteškoća na djelomičnim protezama koje su bile retinirane na implantatima (12, 13).

No većini pacijenata implantati standardne veličine ne mogu se ugraditi u području molara zbog anatomskih ograničenja (horizontalna ili vertikalna alveolarna resorpcija kosti), a bez dodatnih postupaka augmentacije kosti (14, 15). Zbog resorpcije alveolarnog grebena, mandibularni kanal katkad može biti smješten samo nekoliko milimetara ispod vrha alveolarnog grebena. Zato se implantati standardne veličine najčešće mogu ugraditi u području prvog premolara za retenciju i potporu djelomične proteze. Na taj način, ovako mezijalnije postavljen implantat još uvijek ostavlja Kennedyjevu klasu I. Implantati postavljeni u području molara pretvaraju Kennedyjevu klasu I u Kennedyjevu klasu III. No u literaturi nije zabilježena nikakva razlika u žvakanju i u gubitku kosti oko implantata ili razlika u drugim kliničkim/radiološkim parametrima, ovisno o položaju implantata (molar ili premolar) (16 – 18). Implantati standardnih veličina u području prvog premolara zahtijevaju minimalnu širinu alveolarnog grebena od 5,5 mm u bukolinglavnom smjeru, što često nije slučaj kod dugogodišnjih nositelja djelomičnih proteza kojima se često pojavljuje gubitak kosti i sužavanje rezidualnog grebena.

Minidentalni implantati (MDI) uski su jednodijelni implantati koji se koriste za retenciju potpunih donjih proteza za pacijente s uskim alveolarnim grebenima. Prema konsenzusnoj izjavi *International Implantology Teama* – ITI-ja, preporučeno je da se četiri MDI-ja, (dugih najmanje 10 mm i širokih 1,9 – 2,5 mm), ugrade u intraforaminalnu regiju za retenciju potpune proteze (19 – 22). No dosad nisu provedena nikakva istraživanja o tomu može li se MDI koristiti za poboljšanje retencije i stabilnost donjih djelomičnih proteza produženih sedala. Također nisu provedena istraživanja o tomu kakvi će biti kratkoročni i/ili dugoročni učinci takva oblika terapije.

c. implant assisted RPD (IA-RPD)
d. fixed partial dentures on dental implants (I-FPD).

The rehabilitation with the A-RPD usually requires the remaining anterior teeth preparation and a construction of a fixed partial denture (FPD) with incorporated attachments prior to the manufacture of a RPD.

Osseointegrated implants can be incorporated into RPD designs in an effort to overcome adverse effects of dislodging forces upon a RPD and adverse effects of strain forces to abutment teeth. Most design systems include standard size dental implants (SSI) in previous molar sites (7, 8). Implant-assisted RPDs have healing abutments on distal implants as vertical stops, providing only support to a RPD, thus disabling denture saddle subsidence in posterior alveolar ridge sites (9, 10). Implant-retained RPDs have abutments with an attachment system for retention of a RPD (7, 8, 11), thus providing both, support and retention to a RPD. It was reported that patients were more satisfied with implant-retained RPDs (12), but there was also a higher rate of late implant failure and maintenance issues (12, 13). However, in majority of patients standard size implants cannot be inserted in previous molar sites due to anatomical restrictions (horizontal or vertical alveolar bone atrophy) without performing alveolar augmentation procedures (14, 15). Due to the alveolar ridge atrophy, the mandibular canal can sometimes be located only few millimeters below the crest of the ridge. Therefore, some designs place standard size implants in premolar sites to assist or retain a RPD. More mesial implant placement still retains the Kennedy Class I status, while implants in molar sites change the Kennedy Class I to the Kennedy Class III. However, no difference between masticatory outcomes, periimplant bone loss, or other clinical/radiographic parameters in relation to implant position (molar or premolar) has been reported (16-18). Standard size implants in the first premolar sites require minimum alveolar ridge width of 5.5 mm in the buccal-lingual direction, which is often not available in long-term RPD wearers due to bone atrophy in buccal-lingual direction.

Mini dental implants (MDI) are slim one-piece implants recommended to retain mandibular complete dentures in patients with thin/narrow alveolar ridges. Usually four MDIs of at least 10 mm length are recommended to be inserted in the intraforaminal region (19-22). However, no studies have been conducted on whether MDIs can be used for better retention and stability of mandibular long saddle RPDs and what short and/or long-term effects would such treatment provide.

www.ascro.hr

Svrha istraživanja

Željela se procijeniti veličina učinka terapije za pacijente s gubitkom zuba u posteriornoj regiji (Kennedyjeva klasa I) kojima su izrađene nove djelomične proteze retinirane na dvama mini-dentalnim implantatima u mandibuli. Cilj je također bio usporediti veličinu učinka terapije (*effect size*) između pacijenata kojima su izrađene nove djelomične proteze retinirane na mini-implantatima i onih kojima su izrađene nove konvencionalne djelomične proteze retinirane kvačicama. Cilj je bio i pratiti navedene pacijente najmanje šest mjeseci nakon preuzimanja proteza.

Materijali i metode

Dizajn i protokol uključivanja pacijenata

U istraživanje su bili uključeni pacijenti (Kennedyjeva klasa I) bez zuba u posteriornoj regiji, a koji su došli zato što im je trebala nova donja djelomična proteza. Kriterij za uključivanje bio je: samo prednji zubi u mandibuli – maksimalno 6, minimalno 4. Takav raspored preostalih prednjih zuba pruža samo linearnu potporu protezi u mandibuli. Uzeta je potpuna medicinska anamneza i obavljen je klinički pregled. Napravljene su također panoramske i/ili CBCT snimke prije terapije. Svi pacijenti čija je širina alveoralnog grebena u bukolingvalnom smjeru u području prvog premolara ili očnjaka bila manja od 4,5 mm (tako da nisu mogli biti ugrađeni implantati standardne širine bez augmentacije) bili su uključeni u skupinu MDI-DP nakon što su potpisali informirani pristanak. Širina grebena bila je izmjerena šestarom nakon anestezije oralne sluznice i/ili nakon dobivanja CBCT snimke na digitalnoj slici. Duljina kosti morala je biti najmanje 10 mm, a vrijeme proteklo od vađenja zadnjeg zuba najmanje 6 mjeseci. Bolesnici s pomičnom sluznicom iznad alveolarnog grebena (*flabby ridge*) bili su isključeni iz istraživanja.

Zapravo, pacijenti koji su ispunjavali navedene kriterije pokušali su se nasumično raspodijeliti u dvije skupine (MDI-DP ili C-DP) s omjerom raspodjele 1 : 1. No neki nisu htjeli da im se ugradi MDI (bez ikakve naknade), a neki su imali medicinske kontraindikacije za ugradnju MDI-ja. Takvi pacijenti premješteni su u skupinu C-DP. Suglasnost je dobivena od Etičkog povjerenstva ustanove, a svaki je sudionik potpisao informirani pristanak.

Kriteriji isključivanja pacijenata za ugradnju MDI-ja bili su loše opće zdravstveno stanje (klasa III – IV prema klasifikaciji Američkoga društva anesteziologa (ASA) (23), teške bubrežne ili jetrene bolesti, radioterapija u području glave i vrata, kemoterapija tijekom kirurškog zahvata, nekompenzirani dijabetes, HIV), intravenska terapija bisfosfonatom, psihički poremećaji (anamnestički) i zlouporaba droga (anamnestički).

U skupini onih koji su dobili MDI, dvojici je pacijenata jedan od dvaju ugrađenih MDI-ja ispao prije opterećenja te su i oni isključeni iz istraživanja.

U konvencionalnoj skupini djelomičnih proteza (C-DP) sudjelovala su 52 pacijenta (36 žena, 16 muškaraca) u dobi od 56 do 84 godine, a u skupini MDI-DP bilo je 38 pacijenata (27 žena, 11 muškaraca) u dobi od 43 do 81 godine. Dva pacijenta bila su isključena iz skupine MDI-DP zbog odbaci-

Aim

The aim of this study was to assess the effect size of a treatment in patients without posterior teeth (Kennedy Class I) treated by RPDs retained on 2 MDIs in the mandible. The aim was also to compare the esthetic and masticatory outcomes of such treatment between the MDI-retained RPDs and the clasp-retained RPDs (C-RPD) and to follow-up such patients for the period of first 6 months.

Materials and Methods

Design and eligibility criteria

A convenience sample of patients of Kennedy Class I without all posterior teeth (only frontal teeth left -maximum 6, minimum 4), providing only linear support to a denture in the mandible were selected from patients who had been referred for a treatment with a new mandibular RPD. Full medical history was taken and clinical examination was performed. Panoramic radiographs and/or CBCT before treatment were also obtained. For inclusion into the MDI-RPD group the buccolingual alveolar ridge width needed to be less than 4.5 mm in the first premolar or canine region (measured with a caliper after a topic anesthesia of oral mucosa and/or after obtaining a CBCT). The bone length needed to be at least 10 mm and the time elapsed from any tooth removal had to be at least 6 months. The patients with flabby alveolar ridges were excluded.

The patients who met such criteria were attempted to be distributed randomly into the 2 treatment groups (MDI-RPD or C-RPD) with the 1:1 allocation ratio. However, those patients who were not willing to receive MDIs (free of any charge) or patients with medical contraindication for MDI insertion were relocated into the C-RPD group. Full ethical approval was obtained from the Institutional Ethic Committee and each participant signed the informed consent.

The exclusion criteria for the MDI insertion were: poor general health (Class III-IV according to the classification of the American Society of Anesthesiology (23) severe renal/or liver disease, history of a radiotherapy in the head and neck region, chemotherapy at the time of surgical procedure, non-compensated diabetes mellitus, HIV), ongoing intravenous bisphosphonate therapy, mental disorders (anamnestic), drug abuse (anamnestic). In 2 patients one of two inserted MDIs failed before loading and they were also excluded from the study.

A total of 52 patients (36 females and 16 males) in the 56-84 year-old age group participated in the C-RPD group and 38 patients (27 females and 11 males) in the 43-81 year-old age group participated in the MDI-RPD group. Two patients were excluded from the MDI-RPD due to surgical MDI failures; therefore a total of 36 patients (26 females and 10 males) participated in the respective group. All patients had complete dentures in the maxilla.

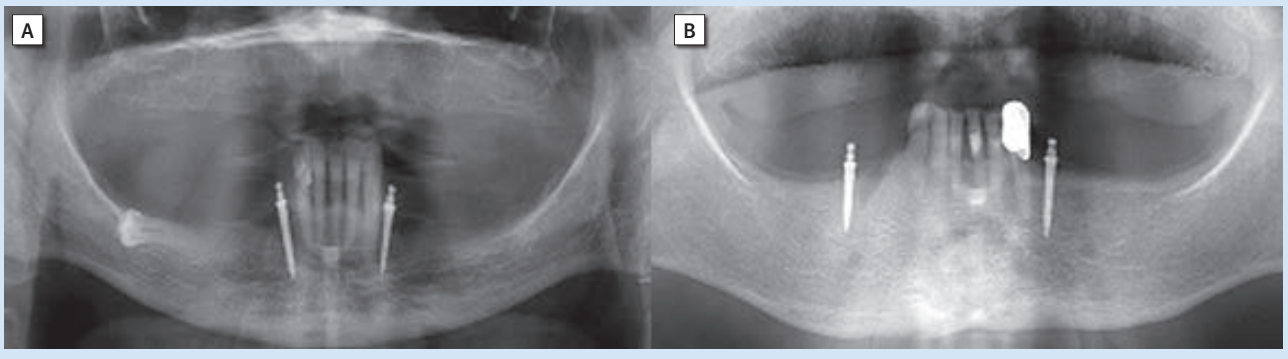
vanja implantata (po jedan implantat kod svakoga), tako da je ukupan broj pacijenata u skupini MDI-DP na kraju bio 36 (26 žena i 10 muškaraca). Svi su u gornjoj čeljusti imali potpune proteze.

Ugradnja MDI-ja

Prije ugradnje MDI-ja, svi su pacijenti klinički pregledani, uz detaljnu analizu panoramskih i/ili CBCT snimki. Sve kirurške zahvate obavili su specijalizanti pod nadzorom dvaju iskusnih specijalista – jednoga stomatološke protetike i jednoga oralne kirurgije. Svim pacijentima propisani su antibiotici prije kirurškog zahvata, tj. 2 g Amoksicilina ili 600 mg Clyndamicina, jedan sat prije operacije. Dimenzije MDI-ja odabrane su ovisno o dostupnoj kosti (Dentium, Seul, Južna Koreja – 2,0 ili 2,5 mm širine i 10, 12 ili 14 mm duljine). Postavljeni su u skladu s uputama proizvođača kalibriranim svrdlima, uz primjenu fiziodispenzera (W & H Implantmed, GmbH, Austrija) i fiziološke otopine za hlađenje kosti i svrdala pri ugradnji te pod lokalnom anestezijom (Ubistesine forte 4 % ili Mepivastesin 3 %, 3M, Njemačka). Svi minidentalni implantati ugrađeni su bez otvaranja mukoperiostalnog režnja. MDI-ji su bili postavljeni na strateške pozicije, distalnije od zadnjeg zuba u zubnom nizu i to odmah pokraj ili otprilike za širinu jednog zuba distalnije od zadnjeg zuba u području prvog premolara ili očnjaka (slika 1.). Nakon kirurškog zahvata pacijentima je propisan antiseptik za ispiranje usta (klorheksidin-glukonat 0,12 % dva puta na dan pet dana) te im je savjetovano da uzimaju analgetike (nesteroidni protuupalni lijek, npr., Ibuprofen 400 mg) jedan sat poslije operacije i ako je potrebno do pet dana poslije operacije. Pacijenti su također bili informirani o standardnim postupcima nakon kirurškog zahvata (ledeni oblozi izvana, redovita i temeljita oralna higijena, izbjegavanje vrućih jela ili toplih napitaka prva dva dana poslije operacije).

MDI insertion

Prior to insertion of the MDIs, all patients were examined clinically, with a detailed analysis of panoramic radiographs and/or CBCT-s. All surgical procedures were performed by residents under supervision of two experienced specialists, one prosthodontist and one oral surgeon. All patients were prescribed antibiotics prior to surgical procedure, i.e., 2 g of Amoxicillin or 600 mg of Clyndamicin, one hour before surgery. The MDIs dimensions were chosen depending on the available bone (Dentium, Seoul, South Korea – 2.0 or 2.5 mm wide and 10, 12, or 14 mm long). They were placed according to the manufacturer's instructions using the calibrated burs, a physiodispenser (W&H Implantmed, GmbH, Austria) and saline solution for drill cooling, under local anesthesia (Ubistesine forte 4% or Mepivastesin 3%, 3M, Germany). All MDI insertions were performed without reflecting the mucoperiostal flap. All MDIs were placed distally to the last remaining tooth in the mandible or one tooth width posteriorly, at the sites of previous first premolars or canines (Figure 1). After surgical procedure, the patients were prescribed an antiseptic mouth rinse (chlorhexidine gluconate 0.12% twice daily for 5 days) and were advised to take analgesics (non-steroid anti-inflammatory drug – e.g., ibuprofen 400 mg) one hour after surgery and if necessary up to 5 days. Patients were also provided with standard post-surgical instructions (ice packs from the outside, regular and meticulous oral hygiene, and they were advised to avoid eating hot food or drinking hot beverages for the first two days after surgery.



Slika 1. Panoramske radiografske snimke dvaju pacijenata s ugrađenim MDI-jem: impaktirani treći molar (A) i gubitak zuba u posteriornoj regiji donje čeljusti s ugrađenim minidentalnim implantatima (MDI) za retenciju djelomične proteze (MDI-DP); MDI je odmah pokraj zadnjeg zuba u zubnom nizu (A) ili otprilike za širinu jednog zuba distalnije od zadnjeg zuba (B)

Figure 1 Panoramic radiograph of the patient with impacted third molar (A) and missing abutment teeth in posterior mandible rehabilitated with a mini dental implant (MDI) to support removable partial dentures (MDI-RPD). MDIs are inserted either adjacent (A) or one tooth width posteriorly to the last remaining tooth (B).

Dizajn djelomične proteze

Sve djelomične proteze napravili su specijalizanti stomatološke protetike pod nadzorom iskusnog stručnjaka, specijalista stomatološke protetike. Djelomične proteze bile su ojačane metalom (Co-Cr legura) kako bi se spriječilo njezino lomlje-

RPD design

All RPDs were made by prosthodontic residents under supervision of one experienced specialist. The RPDs were reinforced with Co-Cr framework in order to prevent fractures. All RPDs had lingual plate major connectors and raised cin-

www.ascro.hr

nje. Velika spojka djelomične proteze bila je puna jezična ploča s ovratnicima iznad cinguluma (cingulumi su bili malo naglašeni preparacijom, ako je bilo moguće) na preostalim zubima i očnjacima (u slučaju kada su očnjaci bili prisutni). Individualni otisci uzeti su u individualnim žlicama u termoplastičnom materijalu za rubove (ISO Functional Stick, GC, Tokio, Japan) i silikonu srednje viskoznosti (Dimension™ VPS Impression Material, 3M ESPE, Seefeld, Njemačka). Za otisak na minidentalnim implantatima, prijenosne kapice bile su postavljene na njih prije otiska, laboratorijski analozi su ugrađeni u izlivene modele i retencijske kapice (matrice) postavljene su na laboratorijske analoge. U skupini C-DP pacijentima su kvačice bile postavljene u protezi za retenciju na najdistalnijem zubu u preostalom zubnom nizu.

Procjena pacijenta o ishodu terapije

Pacijenti su procijenili svoju orofacijalnu estetiku prije terapije, nakon terapije (nakon preuzimanja i prilagodbe djelomične proteze) i poslije šest mjeseci. Također su procijenili sigurnost pri žvakanju tvrde hrane, usitnjenost hrane nakon žvakanja i udobnost nošenja djelomičnih proteza. Sve su procjene obavljene s pomoću vizualno-analogne ljestvice (ljestvica VAS) od 0 do 10, a viši rezultati VAS-a značili su bolje rezultate.

Statističke metode

Za statističku analizu rezultata upotrijebljen je SPSS program koji je uključivao deskriptivnu statistiku, t-test za neovisne uzorke i standardizirani izračun veličine učinka prema formuli: veličina efekta (učinka) terapije = X (zbroj bodova prije terapije – zbroj bodova nakon terapije)/ standardna devijacija zbroja bodova prije terapije (22).

Rezultati

Ukupno je 38 pacijenata dobilo po dva MDI-ja, ali implantati su bili opterećeni samo kod njih 36. Dva su pacijenta bila isključena iz daljnjeg istraživanja zbog gubitka po jednog MDI-ja, što čini 97,4 % preživljavanja MDI-ja u ovom istraživanju prije opterećenja implantata. Nakon opterećenja (36 pacijenata) i šest mjeseci uporabe proteze, preživljavanje MDI-ja bilo je 100 % (opterećeni MDI-ji). Na slici 2. a su srednje vrijednosti i standardne devijacije pacijentove procjene sigurnosti pri žvakanju tvrde hrane, efikasnosti žvakanja i usitnjenosti hrane, orofacijalne estetike i procjene udobnosti nošenja starih proteza (prije terapije s novim protezama i prije ugradnje MDI-ja). Srednje vrijednosti i standardne devijacije pacijentove procjene sigurnosti pri žvakanju tvrde hrane, efikasnosti žvakanja i usitnjenosti hrane, orofacijalne estetike i ugodnosti nošenja i zadovoljstva novim protezama nakon ugradnje MDI-ja i preuzimanja novih proteza te završenih svih prilagodbi prikazane su na slici 2. b. Iste procjene nakon šest mjeseci nošenja novih proteza vidi na slici 2. c.

Iako su stare proteze bile u različitom stanju i različite kvalitete, nije bilo značajne razlike između njihovih procjena kod pacijenata u budućoj skupini C-DP i budućoj skupini MDI-DP ($p > 0,05$). No nakon završene terapije (preuzimanje i prilagodba novih proteza) skupina MDI-DP pokazala je značajno bolje rezultate od skupine C-DP ($p < 0,01$). Razlika

gulum on remaining canines (in cases when they were present). Individual impressions in custom trays were obtained from each patient by impression compound (ISO Functional Stick, GC, Tokyo, Japan) for borders and a medium viscosity silicone (Dimension™ VPS Impression Material, 3M ESPE, Seefeld, Germany). For MDI-RPD impression, transfer caps were attached on the MDIs before impression, laboratory analogues were inserted, and o-ball matrices were attached on the MDI analogues. In the C-RPD group, the clasps were placed on distal remaining teeth.

Patient centered outcomes

Patients assessed their orofacial esthetics prior to treatment, after treatment (RPDs delivered and all adjustments finished), and after a period of 6 month. Patients also assessed how confident they were while chewing hard food, how efficiently their food was comminuted and how confident they were with their RPDs. All assessments were made using the 0-10 visual-analogue scale (VAS scale) and higher VAS scores represented better results.

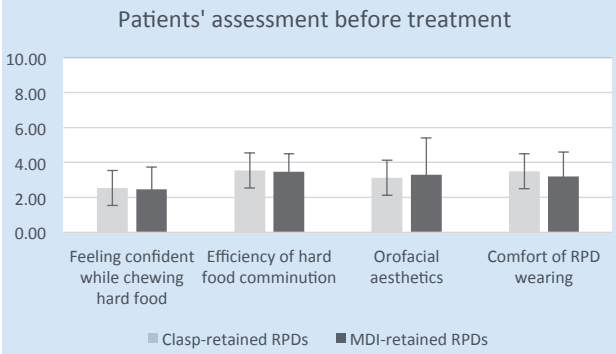
Statistical analysis

The SPSS for Windows software was used for statistical analysis. It included descriptive statistics, t-test for independent samples, and standardized effect size calculation using the formula: Mean (baseline score – follow-up score) / standard deviation of the baseline score (22).

Results

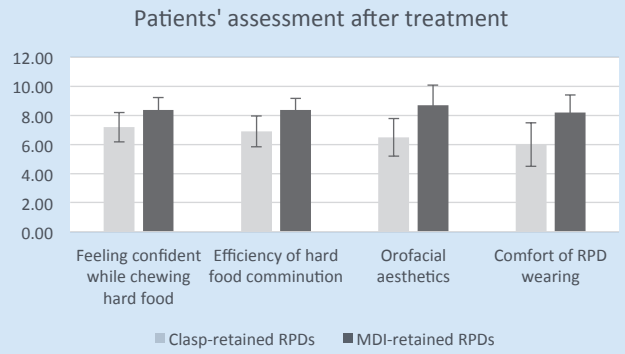
A total of 38 patients received 2 MDIs each, but in only 36 of them their MDIs were loaded. Two patients were excluded before loading, since each of them lost one MDI, representing the 97.4% of surgical MDI survival. At a 6-month follow-up in 36 patients, all loaded MDIs survived (100%). The mean values and standard deviations of patients' assessment of their confidence while chewing hard food, their assessment about how efficiently the food was comminuted, the assessment of their orofacial esthetics and of their comfort with denture wearing (their old dentures) prior to treatment are presented in Figure 2a. The mean values and standard deviations of patients' assessment of their confidence while chewing hard food, their assessment about how efficiently was food comminuted, assessment of their orofacial esthetic appearance and their comfort with new dentures, after treatment and all adjustments had been finished are presented in Figure 2b. The same assessments after a period of 6 month of their new RPD wearing are presented in Figure 2c.

Although old dentures were of various state and quality before treatment, there were no significant differences between patients assigned either to the C-RPD or to the MDI-RPD group ($p>0.05$). However, after treatment the MDI-RPD wearers achieved significantly higher all post-treatment scores than the C-RPD wearers ($p<0.01$). The dif-



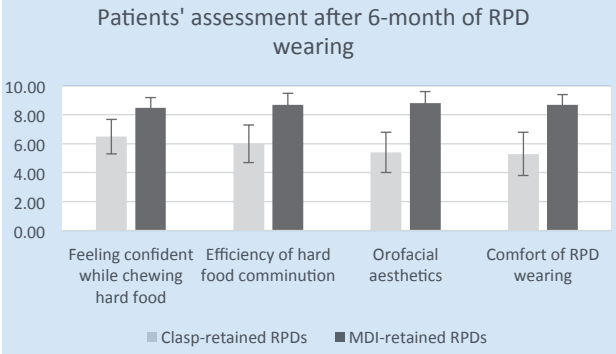
Slika 2a. Pacijentova procjena sigurnosti pri žvakanju tvrde hrane, procjena efikasnosti žvakanja i usitnjenosti hrane, procjena orofacijalne estetike i udobnosti nošenja djelomične proteze: prije terapije (stare proteze); clasp-retained RPDs = pacijenti koji će dobiti djelomične proteze retinirane kvačicama; MDI-retained RPDs = pacijenti koji će dobiti djelomične proteze retinirane minidentalnim implantatima

Figure 2a Patients' assessment of their confidence while chewing hard food, efficiency of food comminution, orofacial esthetics and a comfort of their old removable partial denture wearing before treatment



Slika 2b. Pacijentova procjena sigurnosti pri žvakanju tvrde hrane, procjena efikasnosti žvakanja i usitnjenosti hrane, procjena orofacijalne estetike i udobnosti nošenja djelomične proteze nakon završene terapije i prilagodbe novih proteze; clasp-retained RPDs = pacijenti koji su dobili djelomične proteze retinirane kvačicama; MDI-retained RPDs = pacijenti koji su dobili djelomične proteze retinirane minidentalnim implantatima

Figure 2b Patients' assessment of their confidence while chewing hard food, efficiency of food comminution, orofacial esthetics and a comfort of their new removable partial denture wearing after the treatment and all adjustments finished



Slika 2c. Pacijentova procjena sigurnosti pri žvakanju tvrde hrane, procjena efikasnosti žvakanja i usitnjenosti hrane, procjena orofacijalne estetike i udobnosti nošenja djelomične proteze nakon 6 mjeseci nošenja novih proteza; clasp-retained RPDs = pacijenti koji su dobili djelomične proteze retinirane kvačivama; MDI-retained RPDs = pacijenti koji su dobili djelomične proteze retinirane mini- dentalnim implantatima

Figure 2c Patients' assessment of their confidence while chewing hard food, efficiency of food comminution, orofacial esthetics and a comfort of removable partial denture wearing at the 6-month follow-up clinical examination

između procjena prije i poslije terapije bila je znatno veća u skupini MDI-DP za ocjenu sigurnosti pri žvakanju tvrde hrane ($t = 11,09$, $DF = 86$, $p < 0.01$), ocjenu efikasnosti žvakanja i usitnjenosti hrane ($t = 7,16$, $DF = 86$, $p < 0,01$), ocjenu orofacijalne estetike ($t = 8,8$, $DF = 86$, $p < 0,01$) i ocjenu udobnosti nošenja proteze $t = 6,9$, $DF = 86$, $p < 0.01$). Veličina učinka terapije na orofacijalnu estetiku bila je 2,9 u skupini C-DP, a 3,38 u skupini MDI-DP. Dakle, obje skupine pokazale su značajno velik učinak terapije (*effect size*) (24). Veličina učinka terapije za procjenu sigurnosti pri žvakanju tvrde hrane bila je 3,05 u skupini C-DP i 6,19 u skupini MDI-DP, a veličina učinka terapije za žvakanje tvrde hrane iznosila je 2,1 u skupini C-DP i 4,43 u skupini MDI-DP. Veličina učinka za procjenu udobnosti nošenja proteze bila je također velika – 3,0 u skupini C-DP i 4,9 u skupini MDI-DP. Sve vrijednosti učinka terapije pokazale su visok stupanj efikasnosti terapije (24), ali efikasnost je za sve procijenjene parametre bila veća u skupini MDI-DP. Nakon šest mjeseci svi MDI-ji su preživjeli. U tom trenutku razlika između C-DP-a i MDI-DP-a bila je jače izražena negoli nakon preuzimanja proteza ($p < 0,01$), s obzirom na to da su rezultati u skupini C-DP neznatno pali, a u skupini MDI-DP malo su porasli.

ference between the baseline and the post-treatment data was significantly higher in the MDI-RPD wearers for self-confidence when chewing hard food ($t=11.09$, $DF=86$, $p<0.01$, efficiency of food comminution ($t=7.16$, $DF=86$, $p<0.01$), orofacial esthetics ($t=8,8$, $DF=86$, $p<0,01$) and a comfort of RPD wearing ($t=6.9$, $DF=86$, $p<0.01$). The standardized effect size of the assessment of orofacial esthetics was 2.9 in the C-RPD wearers and 3.38 in the MDI-RPD wearers, being notable in both patient groups (24). The standardized effect size for the self-confidence while chewing hard food amounted to 3.05 in the C-RPD wearers and 6.19 in the MDI-RPD wearers. The standardized effect size for the assessment of food comminution was 2.1 in the C-RPD wearers and 4.43 in the MDI-RPD wearers. The comfort of denture wearing was similarly increased (C-RPD wearers 3.0 and MDI-RPD wearers 4.9). All effect sizes represented high treatment effects (24), but the effect was always higher in the MDI-RPD group.

After the period of 6 month, all MDIs survived. At that point the difference between the C-RPD and the MDI-RPD group was even more pronounced ($p<0.01$), as in the C-RPD group the scores dropped down slightly, while in the MDI-RPD group the scores further slightly increased.

Rasprava

Implantati standardnih dimenzija su, zahvaljujući raznim suprastrukturama, uspješno korišteni za prevladavanje poteškoća s retencijom i stabilnošću djelomičnih proteza te u sprječavanju neželjenih utjecaja na zube nosače i okolna meka tkiva (7 – 13, 15 – 17). No za implantate standardnih dimenzija potreban je dovoljan volumen kosti koji obično nije adekvatan kod pacijenata koji dugo nose djelomične proteze zbog resorpcije rezidualnog grebena. Minidentalni implantati preporučuju se za pacijente s uskim grebenima, tako da se inseriraju po četiri, tri, ili katkad dva MDI-ja u intraforaminalnoj regiji za retenciju donje totalne proteze (19 – 27). MDI se također uspješno koristi za izradu fiksnih radova (krunica) u prednjoj regiji čeljusti (područje inciziva), a katkad čak i u stražnjoj (molarnoj) regiji mandibule, uz maksimalan oprez i bez dugoročnih rezultata (28 – 30). No u literaturi nema podataka o upotrebi MDI-ja za retenciju i potporu donje djelomične proteze. Prema tome, naš zadatak je bio istražiti učinak ugradnje dva MDI-ja za retenciju i potporu djelomične proteze pacijentima s uskim alveolarnim grebenima. Pacijenti s dovoljnim volumenom kosti, s obzirom na to da su mogli dobiti implantate standardnih dimenzija, nisu bili uključeni u ovo istraživanje.

Iako smo pokušali obaviti randomizaciju uzorka, to nije bilo moguće u cijelosti učiniti ni zbog etičkih razloga (s obzirom na to da su neki pacijenti odbili ugradnju MDI-ja zbog straha od boli), ni zbog medicinskih kontraindikacija kod nekih pacijenata. Pretpostavljeno je da pacijenti koji odbijaju ugradnju MDI-ja zbog straha, preferiraju C-DP te će dati bolje ocjene takvoj terapiji, ali prikupljeni podatci to nisu potvrdili. Pacijenti u skupini MDI-DP pokazali su značajno bolje rezultate nakon terapije i veći učinak provedene terapije.

Orofacijalna estetika jedan je od glavnih čimbenika pacijentova zadovoljstva terapijom (31 – 39). Iako su kvačice na donjim prednjim zubima manje vidljive negoli na gornjima, ipak su pacijenti u skupini C-DP ocijenili svoju estetiku znatno niže. Štoviše, u skupni MDI-DP pacijenti su bolje ocijenili i efikasnost žvakanja i usitnjavanja hrane, samopouzdanje pri žvakanju tvrde hrane i ugodnost nošenja proteze, uz značajno veći učinak terapije. Ugradnjom MDI-ja pretvara se linearno opterećenje u povoljnije, poligonalno opterećenje koje pacijentima pruža veće samopouzdanje pri žvakanju, bolju efikasnost pri žvakanju i veću udobnost nošenja proteze. Početni učinak terapije djelomične bezubosti s pomoću MDI-DP-a pokazuje značajno bolje rezultate od C-DP-a. Jedno istraživanje opisuje razlike između proteza retiniranih retencijskim elementima (A-DP) i onih retiniranih kvačicama (C-DP) (5) u korist kombiniranog rada (proteze retinirane kopčama A-DP-a). Ugradnja dvaju MDI-ja obično je financijski povoljnija od izrade kombiniranih radova koji uključuju brušenje određenog broja zuba nosača i izrade fiksnog nadomjestka te nakon toga izradu djelomične proteze retinirane na tom fiksnom radu s pomoću kopči. Ugradnjom MDI-ja za retenciju djelomične proteze čak se i neki blago pomični zubi ne moraju izvaditi, što bi sigurno bio slučaj da se izrađuje kombinirani rad i bruse zubi. Cijena jednog MDI-ja tri puta je manja od jednog implantata standardnih dimenzija i manja je od kombiniranog rada. Obično ugradnja MDI-ja uzroku-

Discussion

To overcome the problems with a RPD retention and stability and to prevent the adverse effects of a RPD to abutment teeth and tissues of a denture bearing area, standard size implants (SSIs) have been used successfully in various positions with various suprastructures (7-13, 15-17). However, for SSI insertion, the patient needs to have an adequate bone volume, which is often lacking in a long term RPD denture wearers. The MDIs have been recommended for narrow ridges and have been successfully utilized for retention of mandibular complete dentures by inserting 4, 3, and even only 2 MDIs intraforaminally (19-27). The MDIs have also been successfully used for FPD retention in the anterior area, and sometimes even in posterior regions of the mandible (28-30). However, we could not find any reports on utilization of MDIs for retention and support of RPDs in a review of selected dental literature. Therefore, we aimed to study treatment effects of insertion of two MDIs for retention and support of mandibular RPDs in patients with slim ridges. Patients with abundant bone volume were not included, as they could receive SSIs.

Although we tried to perform a randomization, it was eventually not possible or ethical, since some patients refused the placement of the MDIs due to pain-related fears. We hypothesized that such patients would favor C-RPDs, but the obtained data did not show that. The patients who received the MDI-RPDs had significantly higher scores after treatment and showed larger size effects of the provided treatment.

Orofacial esthetics represents one of the most important components of patient's satisfaction (31-37). Although clasps are less visible on mandibular frontal teeth than on maxillary frontal teeth, patients obviously rated their orofacial esthetics lower when they had the C-RPDs. Moreover, the MDI-RPD wearers rated higher than the C-RPD wearers the food comminution, the confidence while chewing and their comfort of denture wearing. They also showed larger effect size of the treatment than the C-RPD wearers. The MDIs which were inserted one or two tooth width distally from the last remaining tooth, obviously provided better support and retention of the RPDs. The MDI insertion converted linear into more favorable polygonal support to a RPD and that obviously allowed patients higher self-confidence while chewing, better food comminution and comfort. Initial treatment effects of the MDI-RPDs show better results than of the C-RPDs. A previous study reported the outcomes by comparing the A-RPD and C-RPD (5). Insertion of 2 MDIs is usually even less expensive than construction of any A-RPD, which requires teeth preparation and construction of a FPD with incorporated attachments prior to a fabrication of an RPD. With insertion of MDIs to enhance a RPD's retention and support, even slightly movable teeth can be left in patient's mouth, which would probably be extracted for the A-RPD construction. The price of one MDI is almost three times lower than that of one SSI, and lower than the A-RPD. Usually, the MDI insertion elicits less pain than the SSI insertion, especially when placed without reflecting a flap (38), favoring

www.ascro.hr

je manje boli od ugradnje implantata standardnih dimenzija, posebno kada se ugrađuje tehnikom bez odizanja režnja (40), što sigurno pogoduje i veoma starim pacijentima. S obzirom na dosadašnje spoznaje, oblik terapije MDI-DP-a mogao bi biti jednostavniji, jeftiniji, čak i bolji u odnosu prema kombiniranim radovima. No potrebna su dugoročnija praćenja kako bi se vidjelo hoće li se MDI-DP pokazati kao valjana opcija u svakodnevnoj kliničkoj praksi. Uzevši u obzir da je donja potpuna proteza retinirana samo s pomoću 2 MDI-ja već pokazala dugotrajan uspjeh (30), te da podjezična puna ploča djelomične proteze s ovratnicima iznad cinguluma donjih prednjih zuba prevenira neželjene sile rotacije proteze oko transverzalne osi, pretpostavljamo da ugradnja dvaju MDI-ja za bolju retenciju i stabilizaciju djelomične proteze može uskoro postati adekvatan i dugoročan oblik terapije. Kako bi se taj oblik terapije pokazao valjanim, planira se nastaviti s redovitim kliničkim i radiološkim praćenjem pacijenata te objavom novih rezultata.

Zaključak

Skupina MDI-DP imala je bolje rezultate procjene orofacijalne estetike, efikasnosti žvakanja tvrde hrane, pokazala je veće samopouzdanje pri žvakanju i bolje je ocijenila udobnost proteze u usporedbi sa skupinom C-DP. Skupina MDI-DP također je imala veći učinak terapije koji je ostao konzistentan tijekom prvih šest mjeseci.

Sukob interesa

Autori nemaju financijski interes u tvrtkama čiji su materijali uključeni u ovaj članak.

Priznanje

Hrvatskoj zakladi za znanost za financiranje projekta br. 1218

them also for very old patients. Considering the presented findings, it seems that the MDI-RPDs might be even more favorable than the A-RPDs.

Long term follow-up studies are needed to evaluate whether the MDI-RPD will be a viable treatment option in a clinical practice. Considering that mandibular complete denture on 2 MDIs has already shown longitudinal success (30), and that the lingual plate major connector above cingulum of mandibular frontal teeth in the RPD wearers prevents some adverse dislodging forces, we assume that the insertion of 2 MDIs for better retention and support of a RPD may soon be confirmed as a viable long-term treatment option. The provided results represent patient centered outcomes for the first 6 month of RPD wearing. To provide a long-term evaluation of our MDI-RPD patients, the authors plan to perform regular follow-ups with clinical and radiographic examination and report on results in a future study.

Conclusions

The MDI-RPD wearers reported better post-treatment orofacial esthetics, better hard food comminution, higher self-confidence when chewing and better comfort compared to the C-RPD wearers. The MDI-RPD wearers also showed larger effect size of treatment, which stayed consistent through the first 6 month.

Conflict of interest

The authors do not have any financial interest in the companies whose materials are included in this paper.

Acknowledgment

This publication is funded by Croatian Science Foundation Project No. 1218

Abstract

Objective: The aim was to compare esthetic outcomes, masticatory performance and a comfort of removable partial denture (RPD) wearing after receiving: clasp-retained RPD (C-RPD) or mini dental implant-retained RPD (MDI-RPD) in the mandible. **Materials and Methods:** A sample of 88 patients (Kennedy Class I) with all posterior teeth missing and a linear support for a RPD participated. A total of 52 patients (36 females, 16 males; 56 to 84 years old) participated in the C-RPD group and 36 patients (26 females, 10 males; 43 to 81 years old) in the MDI-RPD group. All MDIs were placed adjacent to the last remaining mandibular anterior tooth or one tooth length posteriorly. The new RPDs had Co-Cr frameworks with lingual plate major connectors; the MDI-RPDs were retained by O-ball matrices and the C-RPDs with clasps. Patients answered questions at pre-treatment and post-treatment stages and after 6-months follow-up: how satisfied they had been with esthetic appearance, how confident they were while chewing hard food, how satisfied they were with food comminution and they also evaluated a comfort of RPD wearing. The 0-10 visual-analogue scale was used. Statistics included descriptive methods, t-tests and the standardized effect-size calculation. **Results:** The MDI-RPD wearers were more satisfied with their post-treatment esthetics, food comminution, a comfort with RPDs and had better confidence while chewing than the C-RPD wearers. The MDI-RPD wearers reported larger positive effect of the treatment. The results were consistent throughout the first 6-months period. **Conclusion:** The MDI-RPD patients showed superior outcomes than the C-RPD patients after the treatment and over the 6-month period.

Received: May 28, 2018
Accepted: August 20, 2018

Address for correspondence
Professor Asja Čelebić
University of Zagreb
School of Dental Medicine
Department of Prosthodonthics
Gundulićeva 5, HR-10000 Zagreb
Croatia
phone: +385 1 4802 111
celebic@sfzg.hr

Key words
Removable Partial Denture; Prosthesis Retention; Dental Clasps; Dental Implants; Mastication; Dental Esthetics

References

1. Zlatarić DK, Celebić A, Valentić-Peruzović M. The effect of removable partial dentures on periodontal health of abutment and non-abutment teeth. J Periodontol. 2002 Feb;73(2):137-44.
2. Koyama S, Fuji T, Ohi T, Kadowaki K, Yoda N, Sasaki K. Practice-Based Longitudinal Study of Multifactorial Risk Assessment for Periodontal Condition and Survival of Remaining Teeth in Patients with Removable Partial Dentures. Int J Prosthodont. 2017 Jul 27.

3. Koyama S, Fuji T, Ohi T, Kadowaki K, Yoda N, Sasaki K. Chronological grey scale changes in supporting alveolar bone by removable partial denture placement on patients with periodontal disease: A 6-month follow-up study using digital subtraction analysis. Int J Prosthodont. 2017 Jul 27.
4. da Fonte Porto Carreiro A, de Carvalho Dias K, Correia Lopes AL, Bastos Machado Resende CM, Luz de Aquino Martins AR. Periodontal Conditions of Abutments and Non-Abutments in Removable Partial Dentures over 7 Years of Use. J Prosthodont. 2017 Dec;26(8):644-649.
5. Peršić S, Kranjčić J, Pavičić DK, Mikić VL, Čelebić A. Treatment Outcomes Based on Patients' Self-Reported Measures after Receiving New Clasp or Precision Attachment-Retained Removable Partial Dentures. J Prosthodont. 2017 Feb;26(2):115-122.
6. Naveed H, Aziz MS, Hassan A, Khan W, Azad AA. Patterns of partial edentulism among armed forced personals reporting at armed forces institute of dentistry Pakistan. Pak Oral dent J. 2011;31:217–21. NIJE U PUBMEDU
7. Bortolini S, Natali A, Franchi M, Coggiola A, Consolo U. Implant-retained removable partial dentures: an 8-year retrospective study. J Prosthodont. 2011 Apr;20(3):168-72.
8. El Mekawy NH, El-Negoly SA, Grawish Mel-A, El-Hawary YM. Intracoronal mandibular Kennedy Class I implant-tooth supported removable partial overdenture: a 2-year multicenter prospective study. Int J Oral Maxillofac Implants. 2012 May-Jun;27(3):677-83.
9. Eom JW, Lim YJ, Kim MJ, Kwon HB. Three-dimensional finite element analysis of implant-assisted removable partial dentures. J Prosthet Dent. 2017 Jun;117(6):735-742.
10. Omura AJ, Latthe V, Marin MM, Cagna DR. Implant-assisted removable partial dentures: practical considerations. Gen Dent. 2016 Nov-Dec;64(6):38-45.
11. ELsyad MA, Omran AO, Fouad MM. Strains Around Abutment Teeth with Different Attachments Used for Implant-Assisted Distal Extension Partial Overdentures: An In Vitro Study. J Prosthodont. 2017;2:42-7.
12. Wismeijer D, Tawse-Smith A, Payne AG. Multicentre prospective evaluation of implant-assisted mandibular bilateral distal extension removable partial dentures: patient satisfaction. Clin Oral Implants Res. 2013 Jan;24(1):20-7.
13. Payne AG, Tawse-Smith A, Wismeijer D, De Silva RK, Ma S. Multicentre prospective evaluation of implant-assisted mandibular removable partial dentures: surgical and prosthodontic outcomes. Clin Oral Implants Res. 2017 Jan;28(1):116-125.
14. Kovacic I, Knezovic Zlataric D, Celebic A. Residual ridge atrophy in complete denture wearers and relationship with densitometric values of a cervical spine: a hierarchical regression analysis. Gerodontology. 2012 Jun;29(2):e935-47.
15. Kovacic I, Celebic A, Zlataric DK, Petricević N, Buković D, Bitanga P. Decreasing of residual alveolar ridge height in complete denture wearers. A five year follow-up study. Coll Antropol. 2010 Sep;34(3):1051-6.
16. Jensen C, Speksnijder CM, Raghoebar GM, et al. Implant-supported mandibular removable partial dentures: Functional, clinical and radiographical parameters in relation to implant position. Clin Implant Dent Relat Res. 2017;19:432-39.
17. Jensen C, Raghoebar GM, Kerdijk W, Meijer HJ, Cune MS. Implant-supported mandibular removable partial dentures; patient-based outcome measures in relation to implant position. J Dent. 2016 Dec;55:92-98.
18. Jensen C, Ross J, Feenstra TL, Raghoebar GM, Speksnijder C, Meijer HJA, Cune MS. Cost-effectiveness of implant-supported mandibular removable partial dentures. Clin Oral Implants Res. 2017 May;28(5):594-601.
19. Jawad S, Barclay C, Whittaker W, Tickle M, Walsh T. A pilot randomised controlled trial evaluating mini and conventional implant retained dentures on the function and quality of life of patients with an edentulous mandible. BMC Oral Health. 2017 Feb 15;17(1):53.
20. Schwindling FS, Schwindling FP. Mini dental implants retaining mandibular overdentures: A dental practice-based retrospective analysis. J Prosthodont Res. 2016 Jul;60(3):193-8.
21. Mundt T, Schwahn C, Biffar R, Heinemann F. Changes in Bone Levels Around Mini-Implants in Edentulous Arches. Int J Oral Maxillofac Implants. 2015 Sep-Oct;30(5):1149-55.
22. Elsyad MA.Patient satisfaction and prosthetic aspects with mini-implants retained mandibular overdentures. A 5-year prospective study. Clin Oral Implants Res. 2016 Jul;27(7):926-33.
23. Daabiss M. American Society of Anaesthesiologists physical status classification. Indian J Anaesth. 2011 Mar;55(2):111-5.
24. Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. Hillsdale (NJ): Lawrence Erlbaum Associates; 1988.
25. Allen PF, McMillan AS, Locker D. An assessment of sensitivity to change of the Oral Health Impact Profile in a clinical trial. Community Dent Oral Epidemiol. 2001 Jun;29(3):175-82.
26. Temizel S, Heinemann F, Dirk C, Hasan I. Clinical and radiological investigations of mandibular overdentures supported by conventional or mini-dental implants: A 2-year prospective follow-up study. J Prosthet Dent. 2017 Feb;117(2):239-246.e2.
27. Preoteasa E, Imre M, Preoteasa CT. A 3-year follow-up study of overdentures retained by mini-dental implants. Int J Oral Maxillofac Implants. 2014 Sep-Oct;29(5):1170-6.
28. Peršić S, Palac A, Vojvodić D, et al. Initial effects of a treatment by fixed partial dentures supported by mini dental implants from a patient's point of view. Coll Antropol. 2014 Mar;38(1):275-8.
29. Flanagan D. Mini implants supporting fixed partial dentures in the posterior mandible: a retrospective. J Oral Implantol. 2015 Aug;41(4):e138-43.
30. Warin P, Rungsiyakull P, Rungsiyakull C, Khongkhunthian P. Effects of different numbers of mini-dental implants on alveolar ridge strain distribution under mandibular implant-retained overdentures. J Prosthodont Res. 2018 Jan;62(1):35-43.
31. Oreški NP, Čelebić A, Petričević N. Assessment of esthetic characteristics of the teeth and surrounding anatomical structures. Acta Stomatol Croat. 2017 Mar;51(1):22-32.
32. Peršić S, Ćelić R, Vojvodić D, Petričević N, Kranjčić J, Zlatarić DK, et al. Oral Health-Related Quality of Life in Different Types of Mandibular Implant Overdentures in Function Longer Than 3 Years. Int J Prosthodont. 2016 Jan-Feb;29(1):28-30.
33. Bimbashi V, Čelebić A, Staka G, Hoxha F, Peršić S, Petričević N. Psychometric properties of the Albanian version of the Orofacial Esthetic Scale: OES-ALB. BMC Oral Health. 2015 Aug 26;15:97.
34. John MT, Reissmann DR, Čelebić A, Baba K, Kende D, Larsson P, Rener-Sitar K. Integration of oral health-related quality of life instruments. J Dent. 2016 Oct;53:38-43.
35. Persic S, Milardovic S, Mehulic K, Celebic A. Psychometric properties of the Croatian version of the Orofacial Esthetic Scale and suggestions for modification. Int J Prosthodont. 2011 Nov-Dec;24(6):523-33.
36. John MT, Feuerstahler L, Waller N, Baba K, Larsson P, Celebić A, et al. Confirmatory factor analysis of the Oral Health Impact Profile. J Oral Rehabil. 2014 Sep;41(9):644-52.
37. Lukež A, Katić V, Lauš I, Grbeša M, Špalj S. Frequency, Context and Characteristics of Smile Used in Advertising. Acta Stomatol Croat. 2017 Mar;51(1):41-47.
38. Kovačić I, Peršić S, Kranjčić J, Disha V, Rener-Sitar K, Čelebić A. Short-term Postoperative Pain and Swelling Associated with Mini and Standard-Size Implants in the Same Patients. Int J Prosthodont. 2018;31:117-119.