Treatment of Early Developed Peri-Implantitis in Fibula Graft Site

Liječenje ranoga periimplantitis u presatku fibule

Abstract

The fibula microvascular free flap technique and placement of dental endosseous implants seem to be viable options for reconstructing the mandible, following a resective jaw surgery. The causes of early failures of implants include bone overheating, latent infection by surgical trauma, the factors related with the implant, and overcompression. This case report reviews the mechanisms of early post-implantation bone loss, and suggests the course of treatment for early peri-implantitis for implants that show no mobility. Radiographs and clinical data presented have shown that the surgical treatment of early developed peri-implantitis using GBR methods in free fibula graft sites offers promising and stable results.

Introduction

In the past 25 years, the fibular microvascular free flap technique has become a routine procedure for the reconstruction of the mandible, in order to correct defects of the bone caused by the resection of the tumor. The literature data show that bone grafting and placement of dental endosseous implants seem to be widely accepted treatment options for reconstructing the mandible, following resective jaw surgery (1). Long-term studies show that the survival rate of implants placed into the fibula is acceptable (2).

Early failures of implants are defined as those occurring between first and second-stage surgery, and the causes include bone overheating, latent infection by surgical trauma, the factors related with the implant, and overcompression (3, 4). The early peri-implant changes, apparent on the x-rays around the implants that have not yet been loaded, suggest iatrogenic causes of rapid crestal bone resorption, due to various factors, such as poor indication, extremely hard and poorly vascularized bone, surgical trauma, lack of keratinized gingiva (5).

The authors of this paper suggest that the course of treatment for these peri-implant early changes and bone necrosis

Uvod

U posljednjih 25 godina tehnika fibularnoga mikrovascularnog režnja postala je rutinski postupak u rekonstrukciji donje čeljusti kako bi se ispravili koštani defekti prouzročeni resekcijom tumora. Podatci iz literature pokazuju da su koštani presatci i postavljanje zubnih endoosealnih implantata široko prihvaćene mogućnosti liječenja u rekonstrukciji donje čeljusti nakon resekcije (1).

Dugotrajna ispitivanja pokazuju da je stopa trajnosti implantata ugrađenih u fibulu prihvatljiva (2).

Rani neuspjesi pri ugradnji implantata definiraju se kao oni koji se pojavljuju između prve i druge kirurške faze, a uzroci uključuju pregrijavanje kosti, latentnu infekciju kirurškom traumom, čimbenike povezane s implantatom i prekomerno opterećenje implantata (3, 4). Rani periimplantatni promjeni, vidljive na radiološkim snimkama implantata koji još nisu opterećeni, sugeriraju jatrogene uzroke brze resorpcije krestalne kosti zbog različitih čimbenika, kao što su nepravilna indicaacija, iznimno tvrda i slabo vaskularizirana kost, kirurška trauma i nedostatak keratinizirane gingive (5).

Autori ovoga rada sugeriraju da tijek liječenja ranih periimplantatnih promjena i nekroze kosti oko implantata koji

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around implants that show no mobility, even in the free fibula graft site, can be the guided bone regeneration protocol, with prior surgical debridement of granulation tissue and detailed cleaning of the implant surface.

It is now accepted that clinicians can try to regenerate the bone that was resorbed as a result of infection, following successful decontamination of the implant surface and bone defect. With the re-osseointegration as the ultimate goal, a number of regenerative techniques have been introduced, and various success rates in the use of regenerative procedures have been reported, regardless of radiographic evidence of defect fill (6).

As with treatment of peri-implantitis, the primary objective is the elimination of the biofilm from the implant surface, utilizing one of the various protocols suggested that include the use of antiseptics, antibiotics, air-abrasive devices and lasers (7). The use of laser for decontamination in surgical resective or regenerative therapies may lead to better clinical results than conventional treatment alone (8).

The aim of this paper was to present the management of early developed peri-implantitis in fibula graft site by utilizing surgical protocol for guided bone regeneration and laser-assisted surgical debridement and implant surface sterilization.

Clinical presentation

Pre-implantation clinical findings

A 26-year-old male patient presented to the Department of Implantology, Clinic of Dentistry, following the resection of the right side of the mandible, and reconstruction with the fibular microvascular graft. The patient was referred to this department from the Clinic of Maxillofacial surgery, for the purpose of receiving dental implants in the fibular graft area, and complete prosthetic rehabilitation to replace the missing teeth and the supporting alveolus.

Discharge summary from the Clinic of Maxillofacial Surgery contained following information:

- The need for mandibular resection was the recidivism of previously pathohistologically proven myxoma.
- The course of maxillofacial treatment: First surgery: Reconstruction of the defect with the fibular microvascular autotransplant, fixation of the fragments with mini plates, and rigid intermaxillary immobilization; Second surgery: A day later, due to the development of hematoma in the early postoperative period, revision and hematoma evacuation surgery with anastomosis revision; Third surgery: Eight days following the second surgery, a dehiscence of the intraoral wound was noticed, and a revision of the wound was performed; Fourth surgery: Due to the prominence of the part of the bone transplant, a wound revision with osteotomy of the part of the autotransplant was performed, 20 days after the last procedure.
- The postoperative course was uneventful, with the ad-

Clinical presentation

Klinički prikaz

Klinički nalazi prije implantacije

Pacijent u dobi od 26 godina došao je u Odjel za implantologiju Stomatološke klinike nakon resekcije desne strane donje čeljusti i rekonstrukcije fibularnim mikrovaskularnim presatkom. Uputili su ga liječnici iz Klinike za maksilofacijalnu kirurgiju radi ugradnje zubnih implantata u područje fibularnoga presatka i potpune protetičke rehabilitacije radi nadomještanja nedostajućih zuba i potporne alveole.

Sažetak njegova otpusnoga pisma sadržavao je sljedeće podatke:

- resekcija donje čeljusti bila je učinjena zbog recidiva pathohistološki dokazanog miksoma
- tijek maksilofacijalnog liječenja: prva operacija – resekcija desne strane tijela i kuta donje čeljusti, rekonstrukcija defekta fibularnim mikrovaskularnim autotransplantatom, fiksiranje fragmenta miniplaćicama i kruta internaksilarnog imobilizacije; druga operacija – obavljena je dan poslije prve zbog pojave hematoma u ranom postoperativnom razdoblju te je izvađen hematom iz revizije anatomše; pacijent je liječen antibioticima, redovito se čistila rana i hranio se s pomoću nazogastrične sonde; treća operacija – učinjena je osam dana nakon druge jer je uočena dehisencija intraoralne rane pa je učinjena revizija rane; četvrtva operacija – učinjena je 20 dana nakon posljednjeg postupka, obavljena je zbog prominencije dijela transplantirane kosti, a učinjena je revizija rane s osteotomijom dijela autotransplantsata.

Postoperativni tijek bio je bez poteškoća, uz davanje antibioticika i redovito čišćenje rane. Rana je zaražena per primam, a nakon uklanjanja fiksacije opseg kretanja mandibule bio je u fiziološkim granicama.
ministration of antibiotics and regular wound debride-
ment. The wound healed per primam, and after the
removal of the intramaxillary fixation, the range of man-
dibular movement was within physiological boundaries.

Implantation procedure
Anamnestic data showed no medical history of system-
ic or metabolic diseases, and the patient did not receive any
kind of drug therapy at the time. After a detailed clinical and
radiographic examination, the patient was scheduled for im-
plant surgery, one year following the fibular graft transplan-
tation.
The course of surgery: The procedure was performed
in local anesthesia. After the elevation of the mucoperioste-
al flap, which proved to be difficult due to the abundance
of scar tissue, the bone sockets in the fibular graft site were
prepared, and three Nobel Replace 4,3x10mm implants were
placed in the region of teeth 43, 45 and 46. At that time,
the bone density was assessed as D1, with very low blood
supply. Healing abutments were placed on the implants, and
the wound was sutured around them (Figure 1a). The wound
healed partially per secundam intentionem.

Post-implantation clinical findings
Two weeks after the implantation, delayed healing, mild
gingival inflammation and bleeding on probing was observed
around two distal implants, without any major subjective
symptoms reported by the patient. No mobility of the im-
plants was noted.
Due to anatomical limitations in post-reconstructive sur-
gery (high floor of the mouth), retroalveolar radiographs
could not be obtained, hence the panoramic radiographs were
used to assess peri-implant bone resorption, as has been
described by Gbara et al. in 2007 (9).
Marginal bone radiolucency in the two distal implants re-

gion was observed on the panoramic x-ray, suggesting bone
resorption due to surgical trauma (Figure 1b).

Klinički nalazi nakon implantacije
Dva tjedna nakon implantacije uočeno je odgođeno za-
cjeljivanje, blaga upala gingive i krvarenje pri sondiranju oko
dvaju distalnih implantata, bez ikakvih većih subjektivnih
symptoma. Nije primijećena pomičnost implantata.
Zbog anatomskih ograničenja u postrekonstrukcijskoj ki-
rurgiji (uzdignuto dno usne šupljine), nije se mogla učiniti
retroalveolarna radiološka snimka pa su za procjenu periim-
plantne resorpcije kosti učinjene panoramske snimke, kao što
su opisali Gbara i sur. 2007. godine (9).
Marginalno prosvjetljenje kosti u području dvaju distal-
nih implantata uočeno je na panoramskoj snimci, što upuću-
je na nekrozu kosti zbog kirurške traume (slika 1b).

Course of treatment and outcome
Nonsurgical treatment was implemented: rinsing with
saline and local drug application (Volon A Haftsalbe ung).
Despite the treatments, the resorption of bone seemed to
be more pronounced on the panoramic x-ray at two-month
post-implantation follow-up; therefore, the decision was
made to treat those peri-implant changes with regenerative
surgical technique (Figure 1c).
Upon application of a local anesthetic solution (Ubistes-

in forte 1 : 100000) in implanted regions (infiltration an-
esthesia), the mucoperiosteal flap was elevated and a crater-
shaped bone resorption was observed around the two distal
implants, as well as the granulation tissue filling the defects
(Figure 2a). The Bio-lase Water-lase Express laser was used
to remove granulations. A granulation removal mode was
applied, according to the manufacturer’s instructions. The
mode was then changed and the implant surface was disinf-
ected (Figure 2b). The cleaned surfaces were washed with sa-
line, and a bone substitute Bio-oss, along with collagen mem-
brane Bio-gide were applied, in a guided bone regeneration
attempt (Figure 3a and 3b). The surgical site was closed with

Postupak implantacije
Anamnestički podaci nisu pokazali medicinsku povijest
sistemskih ili metaboličkih bolesti, a pacijent u tom razdoblju
nije imao nikakvu terapiju lijekovima. Nakon detaljnoga klini-
čkoga i radiografskoga pregleda dogovorena je implantacij-
ja, godinu dana nakon trasplantačije fibularnoga presatka.
Tijek operacije: postupak je obavljen u lokalnoj anestezi-
ji; nakon što je podignut mukoperiostalni režanj, što se poka-
zalo zahtjevnim zbog obilja ožiljnoga tkiva, pripremljena su
ležišta za implantate u fibularnom presatku te su u područ-
je usta 43, 45 i 46 postavljena tri implantata Nobel Repla-
ce 4,3 x 10 mm. Tada je gustača kosti procijenjena kao D1,
srvo niskom opskrbom krvelja. Na implantate su postavlj-

ene nadogradnje za cijeljenje, a rana oko njih je sašivena (sli-
ka 1a). Rana je zarasla djelomično per secundam intentionem.

Tijek liječenja i ishod
Primijenjeno je nekirurško liječenje – ispiranje fiziolo-
kom otopinom i lokalna primjena lijeka (Volon A Haftsal-
be ung). Unatoč tretmanima činilo se da je resorpcija kosti
bila izraženija na panoramskoj snimci učinjenoj dva mjesec-a
nakon implantacije. Zato je odlučeno da se te perimplan-
tne promjene liječe regenerativnom kirurškom tehnikom (sli-
ka 1c).
Nakon lokalne anestezije (Ubistesin forte 1 : 100.000)
u implantirana područja (infiltracijska anestezija), odignut je
mukoperiostalni režanj i uočena je resorpcija kosti u obliku
kratera oko dvaju distalnih implantata te granulacijsko tki-
vo koje ispunjava defekt (slika 2a). Za uklanjanje granulaci-
ja korišten je bio laser Water-lase Express. Primijenjen je mod
za uklanjanje granulacija prema uputama proizvođača. Na-
kon toga je promijenjen mod i površina implantata je dezinficirana (slika 2b). Očišćene površine isprane su fiziološkom
otopinom i u vođenoj regeneraciji kosti postavljen jest
mjestak za kost Bio-oss, zajedno s kolagenom membranom
Bio-gide, (slike 3a i 3b). Kirurško mjesto zatvoreno je pojedi-
načnim šavovima. Propisana je sistemска antibiotska terapija
Figure 1 Panoramic x-ray immediately after implantation surgery (a), two weeks after implantation surgery, with early signs of crestal radiolucency around two distal implants (b), two months post-implantation follow-up, with clear signs of bone necrosis progressing around two distal implants (c)

Slika 1. Panoramska snimka neposredno nakon operacije implantacije; (a), dva tjedna nakon implantacije, s ranim znakovima prosjetljenja krestalne kosti oko dvaju distalnih implantata; (b), dva mjeseca nakon implantacije s jasnim znakovima napredovanja nekroze kosti oko dvaju distalnih implantata (c)

Figure 2 Clinical situation after raising the mucoperiosteal flap - the granulation tissue filling the defects (a), and a crater-shaped bone resorption around the two distal implants (b)

Slika 2. Kliničko stanje poslije odizanja mukoperiostalnog režnja – granulacijsko tkivo koje ispunjava koštane defekte (a) i resorpcija kosti u obliku kratera oko dvaju distalnih implantata (b)

Figure 3 The application of bone substitute Bio-oss (a), along with collagen membrane Bio-gide (b)

Slika 3. Primjena Bio-oss koštanog nadomjestka (a), zajedno s Bio-gide kolagenskom membranom (b)

Figure 4 Panoramic x-ray immediately after GBR surgery to assess the results (Figure 6), a

Slika 4. Panoramska snimka neposredno nakon GBR operacije učinjena za procjenu rezultata (slika 6.)

Figure 5 Panoramic x-ray (a) and intraoral status (b) at four months follow-up – the radiolucencies resolved entirely.

Slika 5. Panoramska snimka (a) i intraoralni status (b) nakon četveromjesečnoga praćenja – prosjetljenja su potpuno nestala

Figure 6 The implants loaded with a lateral metal-ceramic bridge – intraoral view

Slika 6. Implantati opterećeni bočnim metal-keramičkim mostom - intraoralni pogled
single interrupted sutures. Systemic antibiotic therapy was prescribed (caps. Amoxicillin, 500mg/8h). A panoramic x-ray was made immediately after surgery to assess the results (Figure 4), as well as at four months follow-up (Figure 5a and 5b). The radiolucencies resolved entirely. Four months after surgery, the implants were loaded with a lateral metal-ceramic bridge (Figure 6).

Discussion

As for etiologies suggested in regard to early implant failure, surgical trauma has been stated among the most common factors. Implant failures due to this factor show early radiographical signs of a crater-shaped crestal bone defect, and are surrounded by granulation and fibrous connective tissue (5).

Thermally-induced bone necrosis and overcompression are the most probable causes of early implant failure, due to the necrosis of the surrounding differentiated and undifferentiated cells, leading to the failure of bone integration (3, 4).

Compression of bone beyond its physiologic tolerance and excessive torque placed on an implant may result in high levels of strain transmitted to the adjacent bone and ischemia with subsequent necrosis, especially in the crestal region of an implant, which is often composed of dense cortical bone with a minimal blood supply (3).

Although early crestal bone loss may produce the environment that is favorable for anaerobic bacterial growth, especially in one phase implant placement technique as in this case, and thus possibly contribute to more bone destruction in following years, there has been no evidence in the literature that peri-implantitis induces crestal bone loss during the healing period and the first year after prosthetic loading at a faster rate than in the years to follow (10, 11).

On the other hand, Sakkas & Colthard stated that infection is the most common explanation for complications that might occur during the healing period and may, as in the case presented here, include signs such as early mucosal dehiscence that can impair the bone healing process which leads to the integration of the implant (12).

Pellegrino et al. showed a satisfactory long-term survival rate of implants placed into the fibula graft site, but they pointed out the problems of peri-implant bone resorption over time, that is mainly related to peri-implant gingival mucositis, due to the soft tissue quality. The authors suggest that skin or connective tissue grafts in planed implant sites, 2-3 months before implantation procedure, seem to offer an aid to manage this problem (2).

Bashutski et al. reported a case in which first signs of radiolucency around implants were apparent one week after implantation, and can clearly be seen 3 weeks post-op, with an apparent delayed healing of the wound, but without clinical signs of infection and no signs of improvement after administration of systemic antibiotic therapy. Histological verification showed aseptic necrosis, with no bacterial infiltration. Some authors believed that overcompression was the most probable cause of the peri-implant necrosis (3).

In our case, there were also no clinical signs of infection, (Amoxicillin, 500 mg/3 x dan). Panoramske snimke učinjene su neposredno poslije kirurškoga zahvata radi procjene rezultata (slika 4) i zatim nakon četveromjesečnoga praćenja (slike 5a i 5b). Prosvjetljenje je potpuno nestalo. Ćetiri mjeseca poslije operacije implantati su opterećeni bočnim metalno-keramičkim mostom (slika 6.).

Rasprava

Kad je riječ o etiologijama predloženima u vezi s ranim neuspješnim postavljanjem implantata, među najčešćim čimbenicima navedena je kirurška trauma. Neuspjesi pri ugradnji implantata zbog toga čimbenika pokazuju rane radiografske znakove oštećenja kosti u obliku kratera, a okruženi su granulacijama i fibroznim vezivnim tkivom (5).

Termički inducirana nekroza kosti i prejaka kompresija najvjerojatnije su uzroci za rani neuspjeh implantata zbog nekroze okolnih diferenciranih i nediferenciranih stanica, što završava neuspješnom integracijom kosti (3, 4).

Kompresija kosti koja prelazi njezinu fiziološku toleranciju i prekomjerna traumatična traumata su najvjerojatniji uzroci za ranu neuspjeh implantata (3, 4).

Vijest o sljedeće implantaciji bavljenja nego odgovor na pregled operacije (5).

Iako rani gubitak kosti se može stvoriti okružje koje je povoljno za anaerobni rast bakterija, posebno u jednofaznoj tehnički ugradnji implantata kao i u ovom slučaju, na taj način može pridonijeti većem unistavanju kosti u sljedećim godinama. U literaturi nema dokaza da periimplantitis brže potiče gubitak kosti u razdoblju zacijeljivanja i tijekom prve godine nakon protetičkog opterećenja nego u godinama koje slijede (10,11).

S druge strane, Sakka i Colthard izjavili su da je infekcija najčešće objašnjenje za komplikacije koje se mogle dogoditi u razdoblju zacijeljivanja i mogu, kao u opisanom slučaju, uključiti znakove poput rane dehiscencije sluznice koja može smanjiti proces zacijeljivanja kosti koji dovodi do integracije implantata (12).

Pellegrino i sur. pokazali su neposrednost stepsu dugotrajnog preživljavanja implanta u presatku fibule, ažum upozorili i na probleme s periimplantnatom koštranom rezorpcija tijekom vremena koji su uglavnom povezani s periimplantnim gingivalnim mukozitom zbog kvalitete mokoča tkiva. Autori sugeriraju da je djeteljenje kože ili vezivnoga tkiva na planiranim mjestima implantacije od 2 do 3 mjeseća prije postupka implantacije može pomoći u rješavanju toga problema (2).

Bashutski i sur. izvijestili su o slučaju u kojemu su prvi znakovi prosvjetljenja oko implantata bili vidljivi tijedan dana nakon implantacije, a jasno su se uočavali 3 tjedna nakon operacije, s prividnim odgođenim zacijeljavanjem rane, ali bez kliničkih simptoma infekcije i bez znakova poboljšanja poslije primjene sistemskih antibiotičke terapije. Histološka verifikacija pokazala je aseptičnu nekrozu bez bakterijske infiltracije. Neki autori pretpostavljaju da je prejaka kompresija najvjerojatniji uzrok periimplantne nekroze (3).
only a delayed per sec healing. Considering the specificity of the case itself, the fact that there was no mobility in the implants, and also that the removal of the implants in this phase would probably lead to major defects in the grafted fibula site and the inability for implant placement without additional grafting, the decision was made to implement a protocol for laser-assisted surgical debridement and implant surface sterilization, followed by a guided bone regeneration procedure.

The decision on surgical technique (resective or regenerative) to treat peri-implantitis-like changes depends on the clinical situation. Even if surgery seems to be the therapy of choice, nonsurgical therapy should always be performed before surgical interventions (7).

If a crater-shaped lesion is present around the infected implant, regenerative techniques are needed. A number of different grafting materials, with or without use of a membrane, or the use of membranes alone, have been proposed over the years, in an attempt to regenerate the lost bone and induce re-osseointegration on the previously contaminated implant surface (13).

In a randomized clinical trial Renvert et al. compared augmented sites, with surface debridement and decontamination alone, and concluded that the successful treatment outcome using a bone substitute was more predictable (14).

In 2019, Di Carlo et al. reported a GBR procedure performed in the post graft site, in which the onset of peri-implantitis led to the failure of osseointegration with consequent thinning of the fibula flap (15).

Following mechanical decontamination, chlorhexidine, citric acid, tetracycline, hydrochloric acid, chloramines, hydrogen peroxide or sodium chloride were used for the purpose of chemical decontamination, and, no agents have yet been shown to be superior (12).

Some authors have suggested that decontamination and detoxification of implant surfaces cannot be achieved using hand curettes in narrow bony defects. Also, the infracrestal application of air-powder abrasives may cause embolization, whereas laser application is not associated with such serious risks (7, 14).

Laser decontamination of the implant surface as an adjunct to surgical regenerative therapies may lead to better clinical results than conventional treatment alone. Clinical improvements have been reported for both the use of lasers and air-abrasive devices on treatment outcome in the short term and the long term, but the evidence is still weak (6, 16).

We have decided to use Bio-lase Water-lase Express laser for granulation removal and implant surface disinfection.

In the study of Serino & Turri, the authors concluded that the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed for the amount of initial bone loss around the implants seemed to affect disease resolution, and that disease progressed.
the therapy guidelines for peri-implantitis in free fibula graft sites.

Conflict of interest

The authors report no conflict of interest

Sukob interesa

 Autori nisu bili u sukobu interesa.

Doprinos autora: Z. T., M. B., N. P. – obavili su implantaciju; Z. T., V. K. – proveli su postupak vođene regeneracije kosti; R. M. – završio je protetički tretman; Z. T., N. P. – pripremili su tekst; M. B., R. M. – kritički su revidirali tekst; V. K. – dao je konačno odobrenje za objavljivanje članka. Svi su autori razgovarali o slučaju i dali svoj doprinos konačnoj verziji teksta.

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