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PRIKAZ SLUČAJA
*CASE REPORT*

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# Minimalno invazivna jednofazna tehnika bez odizanja režnja s imedijatnim nefunkcijskim opterećenjem

# *Minimally Invasive One-Stage Flapless Technique with Immediate Non-Functional Implant Loading*

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**Sažetak**
U suvremenoj dentalnoj implantologiji koriste se tehnike koje uz najmanji mogući invazivni pristup omogućuju pacijentu funkciju, estetiku i ugodnost. Takva jednofazna flapless tehnika u prednjom dijelu gornje čeljusti često se kombinira s funkcionalnim ili nefunkcionalnim imedijatnim opterećenjem implantata. U predstavljenom kliničkom slučaju koristila se neznatno invazivna jednofazna flapless tehnika ugradnje dentalnih implantata, kako bi se nadomjestio gornji desni središnji sjekutić s imedijatnim nefunkcijskim opterećenjem. Opisan je slučaj pacijenta u dobi od 21 godine s kliničkim i radiološkim znakovima vertikalne frakture endodontski liječenoga gornjega desnog središnjeg sjekutića. Nakon ekstrakcije zuba primijenjena je tehnika koštano vođene regeneracije kako bi se prevenirao kolaps postekstrakcijske alveole i osiguralo bolje ležište budućega dentalnog usatka. Četiri mjeseca kasnije transmukoznim kirurškim pristupom ugrađen je dentalni implantat. Položaj usatka određen je na osnovi ortopantomograma te je pomoću kirurške šablone precizno definirano ležište i angulacija implantata. Ugrađeni implantat je imedijatno opskrbljen konačnim batrljkom od cirkonijeve oksidne keramike te privremenom akrilatnom krunicom bez okluzalnih kontakata. Nakon što je cijelila šest mjeseci, oseointegracija implantata procijenjena je adekvatnom nakon analize rezonantnom frekvencijom (vrijednost 75,3). Implantat je tada opskrbljen konačnim fiksno-protetskim nadomjeskom. Tijekom šestomjesečnoga praćenja, pacijent nije imao ni kliničke ni radiološke komplikacije.

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## Uvod

Dentalni implantati danas su vrlo prihvatljivo rješenje ako se treba nadomjestiti jedan zub u prednjem dijelu gornje čeljusti, jer je na tom području estetika jedan od osnovnih prioriteta. Iako je konvencionalni višefazni pristup dentalnoj implantolo-

## Introduction

Dental implants have become widely accepted for the anterior maxillary single-tooth replacement where a esthetics are high priority. Conventional multistage approaches to implant reconstruction have contributed to professionals' acceptance

giji jedno od terapijskih rješenja, inovativne tehnike omogućuju kliničaru da u što kraćem razdoblju postigne funkciju i estetiku (1). U suvremenoj dentalnoj implantologiji koriste se tehnike koje omogućuju pacijentu funkciju, estetiku i ugodnost uz minimalno invazivan kirurški pristup (2). Kod kirurškoga pristupa kada se odiže mukoperiostalni režanj, obično se dogodi gubitak marginalne kosti i recesija mekih tkiva, što je kritično kod implantoprotetske obskrbe jednog zuba u prednjoj maksili, gdje je harmonija mekih i tvrdih tkiva iznimno važna za estetiku, prirodan izgled i funkciju (3). Ugradnja implantata neznatno invazivnom jednofaznom flapless tehnikom znatno smanjuje mogući gubitak alveolarne kosti, upale mekih tkiva te trajanje kirurškog tretmana i nelagodu pacijenta (4, 5). Flapless kirurški pristup je penetracija kroz sluznicu kada se ne odiže mukoperiostalni režnj (6). Zbog toga je manja postoperativna nelagoda kod pacijenta i ne stvara se ožiljkasto tkivo. Održavanje periosta intaktnim s bukalne i lingvalne strane grebena, omogućuje bolju prokrvljenost ležišta implantata te reducira vjerojatnost nastanka resorpcije (5). Tijekom ugradnje usatka potreban je oprez, s obzirom na to da se radi o „slijepoj“ tehnici ugradnje. Pravilna angulacija tijekom preparacije svrdlom osigurava da se izbjegne perforacija kortikalne koštane ploče s lingvalne i bukalne strane grebena, posebice lingvalno u području lateralnih zuba donje čeljusti te u području prednjih zuba gornje čeljusti (7). Klinički uvjeti za primjenu flapless kirurškog pristupa su najmanje 5 mm keratiniziranog tkiva jer se tim pristupom uklanja nešto tkiva, te širina kosti od barem 4,5 mm bez podminiranih prostora većih od 15º (5, 8). Ako postoje podminirani prostor veći od 15º, preporučuje se klasično odizanje mukoperiostalnog režnja zbog bolje pregledosti tijekom ugradnje usatka (5). Flapless kirurški pristup obično se koristi u kombinaciji s jednofaznom postavom dentalnog implantata, što znači da koronarni dio usatka ostaje eksponiran kroz meko tkivo, pa nije potrebna druga kirurška faza kada se implantat otvara (8). Klinički su uvjeti za takvo jednofazno postavljanje implantata zadovoljavajuća kvaliteta kosti (tip I. i II.), njihova odgovarajuća visina i širina, barem 5 mm keratiniziranog tkiva, susjedni zubi koji apsorbiraju okluzalne sile i ostavljaju implantat izvan funkcije te potpuna stabilnost usatka nakon ugradnje (5). Minimalno invazivna jednofazna flapless kirurška tehnika u području prednjih zuba gornje čeljusti obično je povezana s funkcijskim ili nefunkcijskim imedijatnim opterećenjem implantata (9-12). Takvo opterećenje

of implant dentistry as a treatment option, yet innovative implant procedures often enable clinicians to achieve function and esthetics in shorter treatment periods (1). The current trend is to develop techniques that can provide function, esthetics, and comfort with a minimally invasive surgical approach (2). Full-thickness periosteal flap surgery is often accompanied by potential marginal bone loss and soft tissue recession, which are critical for single-unit implant-supported restoration in the anterior maxilla, where the harmony of the soft and hard tissue architecture is of paramount importance to the development of natural esthetics and function (3). Implant placement using minimally invasive one-stage flapless technique has a potential to minimize crestal bone loss, soft tissue inflammation, surgical time, and postoperative patient discomfort (4, 5). Flapless surgical approach requires penetration of the alveolar mucosa and bone without reflection of mucoperiosteal flap (6). Avoiding the creation of a flap results in less postoperative patient discomfort and possible scar tissue formation. Leaving the periosteum intact on the buccal and lingual aspects of the ridge maintains a better blood supply to the site, reducing the likelihood of resorption (5). Since flapless implant placement is generally „blind“ surgical technique, care must be taken when placing implants. Proper angulation of implants affected by drilling is critical to avoid perforation of the cortical bone plates, both lingual and buccal, especially on the lingual in the mandibular molar area and the anterior maxilla (7). Clinical conditions for using flapless approach consider a minimum of 5.0 mm keratinized tissue because the flapless procedure requires the actual removal of some of the tissue, and at least 4.5 mm of bone width must be available without undercuts of more than 15º (5, 8). Traditional flap reflection is recommended if an undercut of more then 15º is detected because of greater visibility when placing the implant (5). The flapless technique is usually considered in conjunction with single-stage implant placement, which means that the implant coronal portion protrudes through the soft tissue and second surgical exposure is not necessary (8). Clinical conditions for single-stage technique are good bone quality (type I and II), adequate bone width and height, at least 5 mm keratinized soft tissue, the presence of adjacent teeth that can absorb the occlusal forces and protect the implant from function, and ability to completely stabilize the implant at the time of placement (5). Minimally invasive one-stage flapless technique in maxillary

skraćuje terapijsko razdoblje te omogućuje pacijentu estetsku satisfakciju tijekom cijele terapije (13).

Opisan je klinički slučaj kod kojega je primijenjena minimalno invazivna jednofazna flapless tehnika kako bi se nadomjestio gornji desni središnji inciziv s imedijatnim nefunkcijskim opterećenjem.

## Klinički slučaj

Kod pacijenta u dobi od 21 godine pronađeni su klinički i radiološki znakovi vertikalne frakture već prije endodontski tretiranoga desnoga gornjeg središnjeg sjekutića. Zub je ekstrahiran nakon što je pacijent potpisao pristanak te je obavljen zahvat koštano vođene regeneracije uz primjenu minerala deproteinizirane goveđe kosti (Bio-Oss®, Geistlich, Njemačka) kao materijala za augmentaciju kosti te bioresorptivne kolagene membrane (Bio-Gide®, Geistlich, Njemačka) kao barijere kako bi se prevenirao kolaps postekstrakcijske alveole i postiglo bolje ležište budućeg implantata. Nakon četiri mjeseca to je područje rendgenski snimljeno i obavljena je klinička evaluacija, te je ustanovljeno da postoje svi uvjeti za jednofaznu flapless kiruršku tehniku. Preparacija ležišta za ugradnju implantata koničnog oblika obavljena je transmukoznim flapless kirurškim pristupom. Lokalizacija usatka određena je na temelju radiološke ortopantomogramske snimke te je izrađena kirurška šablona radi preciznog određivanja angulacije implantata. Nakon lokalne anestezije obavljena je cirkularna incizija 4-milimetarskim tkivnim pančerom kroz pričvrsnu gingivu i periost iznad planiranog ležišta (Slika 1.).

Buko-lingvalna dimenzija kosti bila je izmjerena pomičnom mjerkom za kost prije uporabe tkivnog pančera na trima različitim mjestima - pri vrhu grebena te u području centralnog i apikalnog dijela planiranog implantata. Nije bilo podminiranih djelova u koštanom ležištu većih od 15º. Nakon uporabe tkivnog pančera, kiretom je uklonjen sluznični poklopac i prikazana kost. Kortikalna kost je probušena okruglim svrdlom, a zatim je pokusnim svrdlom debljine 2 mm postignuta željena dubina. Preparacija je proširena i postavljen je implantat širine 3,8 x 11 mm, koničnog oblika i hrapave površine (Xive Implant System, Friadent-Dentsply, SAD -Njemačka). Širina usatka određena je na temelju RTG-snimke, tako da je razmak do susjednog zuba dva milimetra. Implantat je postavljen oko 3 milimetra

anterior region is usually considered in conjunction with functional or non-functional immediate loading (9-12). Immediate loading of dental implants shortens the treatment time and makes it possible to give the patient an esthetic appearance during the whole treatment period (13).

In this report, a clinical case of using minimally invasive one-stage flapless technique for maxillary right central incisor replacement with immediate non-functional loading is presented.

## Clinical case

A patient was a 21-year-old male with clinical and x-ray signs of a vertical fracture of the endodontically treated maxillary right central incisor (Figure 1).

After the patient signed the written informed consent and the tooth extraction, guided bone regeneration (GBR) procedure was performed using deproteinized bovine bone mineral (Bio-Oss®, Geistlich, Germany) as a membrane-supporting material and a bioresorbable collagen membrane (Bio-Gide®, Geistlich, Germany) as a barrier to prevent post extraction alveolus collapse and provide a better site for the future implant. After 4 months a periapical radiograph was taken and clinical evaluation was performed. The area met all conditions for a single-stage flapless surgery technique. A flapless, transmucosal surgical approach was used to prepare the site and insert a tapered implant. Location was determined on the basis of slice ortopantomogram x-rays and surgical drill guide was made for precise definition of implant site and angulation. Under local anesthesia, a 4-mm disposable tissue punch was used to make a circular incision through the attached gingiva and periosteum at the proposed implant site (Figure 2).

Bone caliper was used before using the tissue punch to measure buccal-lingual dimensions at approximately three different points: the top of the ridge, near where the center and the apex of implant would be positioned. There were no undercuts of more than 15º in the bone. After using the tissue punch, a curette was used to remove the plug of soft tissue, exposing the bone. A round bur was used to penetrate the cortical bone, followed by a pilot drill. The bone was entered to the desired depth using a 2mm pilot drill. An osteotomy was then created to accommodate a 3.8 x 11mm tapered, roughened-surface implant (Xive Implant System, Friadent-Dentsply, USA-Germany). The implant diameter was chosen using the x-ray template, with a distance of 2 mm to the adjacent teeth. The implant was inserted approximately 3 mm

**Slika 1.** Minimalno invazivni flapless pristup pomoću tkivnog pančera
**Figure 1** Minimally invasive flapless approach with the tissue punch.

**Slika 2.** Ugradnja implantata
**Figure 2** Implant placement.

**Slika 3.** Konačni batrljak od cirkonijeve oksidne keramike
**Figure 3** Final zirconium oxide ceramic abutment.

**Slika 4.** Privremena akrilatna krunica pri provizionalnom nefunkcijskom opterećenju implantata
**Figure 4** Temporary acrylic crown for provisional non-functional loading.

**Slika 5.** Krunica od cirkonijeve oksidne keramike kao konačni fiksno-protetski nadomjestak
**Figure 5** All-ceramic zirconium-oxide crown as a final fixed prosthetic restoration.

**Slika 6.** Radiološka snimka 6 mjeseci nakon funkcijskog opterećenja implantata
**Figure 6** Radiograph 6 months after functional loading.

ispod razine gingive, kako bi stuba na batrljku bila točno u razini koštanog grebena (Slika 2.). Tijekom ugradnje implantata moment sile je bio 45 Ncm. Usadak je ugrađen tako da je heksagonalno ležište implantata ostalo jedan milimetar iznad ruba alveolarnog grebena, a zatim je imedijatno postavljen konačni batrljak od cirkonijeve oksidne keramike (Slika 3.). Nakon toga je napravljena privremena akrilatna krunica i postavljena izvan okluzije (Slika 4.). U razdoblju nefunkcijskog opterećenja s privremenom akrilatnom krunicom nije bila zapažena nikakva promjena na mekom tkivu, što smo pripisali neinvazivnoj operativnoj tehnici i imedijatnom postavljanju privremene krunice. Nakon šestomjesečnog cijeljenja, oseointegracija je procijenjena s RFA (75,3) i pokazala je zadovoljavajuću vrijednost. Zatim je postavljena krunica od cirkonijeve oksidne keramike kao trajno protetsko rješenje (Slika 5.). U razdoblju od šest mjeseci, koliko se pacijenta pratilo nakon funkcijskog opterećenja, nije imao ni kliničke ni radiološke komplikacije (Slika 6.).

## Rasprava

Klasični implantološki protokol zahtijeva tijekom cijeljenja dvofaznu tehniku bez opterećenja. Danas su klinička istraživanja usmjerena na to da se skrati cijeli tretman, postigne optimalna estetika i poboljšaju rezultati. Suvremena istraživanja pokazuju da je imedijatna opskrba jednog zuba, nakon minimalno invazivnog kirurškog postupka, prihvatljiva terapijska mogućnost (1-3, 11, 13-15).

Flapless tehnika ugradnje dentalnih implantata u načelu je „slijepa“ kirurška tehnika, ali sigurna ako odaberemo odgovarajućeg pacijenta. Njezine su prednosti - kad je riječ o pacijentu, ali i kirurgu - skraćeno vrijeme terapije, minimalno krvarenje tijekom zahvata, brža ugradnja implantata te nema postavljanja i uklanjanja šavova (4, 5, 7, 8). Kod te tehnike pacijentima je potrebno manje analgetika, jer im je osjećaj boli mnogo manji i kraće traje (16). Jeong i suradnici (17) u svojoj su eksperimentalnoj studiji istaknuli da su oseointegracija i visina kosti oko implantata bolji kod flapless tehnike te zaključili kako se neinvazivnom tehnikom implantacije mogu postići čak i bolji rezultati. Becker i suradnici (6) kažu da usadci ugrađni flapless tehnikom imaju istu stabilnost kao i oni postavljeni konvencionalnom kirurškom tehnikom. Campelo i Camara (7) objavili su najopsežniju studiju o uporabi jednofazne flapless kirurške tehnike u dentalnoj implantologiji. U njihovu je desetogodišnjem istraživanju uspješnost 770 implantata postavljenih flapless ki-

under the gingiva level to place the prosthetic abutment platform exactly at the height of the original alveolar bone (Figure 3).

During insertion torque was set at 45 Ncm. The implant was inserted so that 1 mm of its hex remained superior to the crest and then immediately restored with final zirconium oxide ceramic abutment (Figure 4) and temporary acrylic crown without any occlusal contacts (Figure 5).

During the period of provisional non-functional loading, no significant soft tissue contraction was observed related to noninvasive operating techniques and immediate insertion of the provisional restoration. After a healing period of 6 months, the osseointegration was assessed with resonance frequency analysis and considered adequate. The implant was then treated with the final fixed prosthetic restoration, an all ceramic zirconium oxide crown (Figure 6).

The patient exhibited neither clinical nor radiologic complications throughout the 6 months period of clinical monitoring after functional loading.

## Discussion

Conventional implant protocols advocate a two-stage technique with a load-free submerged healing period. Clinical research has now focused on reducing the treatment time, achieving optimum hard and soft tissue esthetics, and improving patient outcomes. Recent studies suggest that immediate restoration of single implants, after minimally invasive surgical approach, may be a viable treatment option (1-3, 11, 13-15).

Flapless implant placement is a generally „blind“ surgical technique, but there should be no problems if the patient has been appropriately selected. There are many advantages for the patient as well as for the surgeon, since the procedure is less time consuming, bleeding is minimal, implant placement is expedited, and there is no need to place or remove sutures (4, 5, 7, 8). With the flapless procedure, patients are taking fewer pain tablets, their pain experience is less intense and lasts for a shorter period of time (16). Jeong et al (17), in their experimental study, have found that the mean osseointegration and the mean periimplant bone height were greater at flapless sites than at sites with flap, so they have concluded that flapless surgery can achieve results superior to surgery with reflected flap. Becker et al (6) have found that implants placed without flap reflection remained stable and exhibited clinically relevant osseointegration similar to when implants were placed using conventional flap procedures. Campelo and Camara (7) have

rurškom tehnikom varirala od 74,1 % do 100 %, ovisno o godini ugradnje. To se može objasniti usavršavanjem tehnike i materijala u dentalnoj implantologiji. Stopa preživljavanja u drugim objavljenim studijama za flapless kiruršku tehniku varira između 91 % i 98,7 % (4, 13, 18), što ističe uspješnost te tehnike.

Privremena provizorna opskrba na dentalnim implantatima vrlo je važan čimbenik u cjelokupnoj terapiji - kako s estetskog, tako i s funkcionalnog stajališta. Hall i suradnici (9) istaknuli su da imedijatno opskrbljeni implantati s protetskog i estetskog stajališta daju isto tako zadovoljavajuće rezultate kao i usadci nakon konvencionalne dvofazne tehnike koji su naknadno protetski opskrbljeni u prvoj godini. Lindeboom i suradnici (10) nisu pronašli veću razliku između imedijatno neopterećenih i imedijatno opterećenih implantata u gornjoj čeljusti u srednjim vrijednostima stupnja stabilnosti implantata (ISQ-a) u radiološki vidljivom gubitku koštanog tkiva te estetskoj komponenti. Rezultati mnogih radova pokazali su da se imedijatnim zbrinjavanjem implantata, ugrađenih u prednjoj regiji gornje čeljusti, postiže velika stopa uspjeha, odnos parodonta i implantata te estetski rezultat, znači harmonija između oblikovanog mekog tkiva i prirodnih oblika (1, 9, 12-14, 19-23). Na osnovi tih rezultata može se zaključiti da su imedijatno funkcijsko opterećenje i imedijatno nefunkcijsko opterećenje tehnike koje omogućuju prihvatljivu stopu uspjeha implantata i predvidljive rezultate.

Terapijski učinak nakon primjene minimalno invazivne flapless kirurške tehnike s imedijatnom opskrbom, u estetskoj se regiji može ocijeniti pozitivnim i sigurnim na osnovi dostupne literature i kliničkog iskustva.

## Zaključak

Minimalno invazivna jednofazna flapless tehnika kod nadomještanja jednog zuba u estetskom području gornje čeljusti s imedijatnim nefunkcijskim opterećenjem, siguran je i uspješan terapijski pristup te rezultira zadovoljstvom implantološkog pacijenta.

published the most extensive study about using one-stage flapless surgical technique in dental implantology. In their 10-year retrospective study the cumulative success rate, for 770 implants using a flapless surgical technique, have varied from 74.1% to 100%, relative to the year of placement, which can be explained with a learning curve combining technology and material development in dental implantology. Survival rates in other reported studies, for flapless surgical approach, are between 91% and 98.7% (4, 13, 18), which indicate successful results of this technique application.

Provisional restorations on dental implants are important factor of overall implant treatment for both esthetic and functional concerns. Hall et al (9) have found that immediately restored implants were as prosthodontically and esthetically successful as conventionally restored two-stage implants during the first year of service. Lindeboom et al (10) have found no significant differences in implant stability quotient (ISQ) mean values, in radiographic bone loss and gingival esthetics between immediate unloaded temporization and immediately loaded implants in the maxilla. The results of many studies suggest that favorable implant success rates, peri-implant tissue responses, and esthetic outcome, like harmoniously scalloped soft tissue lines and natural contours, can be achieved with immediately restored maxillary anterior implants (1, 9, 12-14, 19-23). Therefore, immediate functional loading and immediate non-functional loading appear to be techniques that can provide outstanding implant success rates with significant predictability.

In view of available literature and clinical experiences, treatment outcome associated with the use of minimally invasive flapless surgical technique with immediate restoration in the esthetic zone can be considered positive and predictable.

## Conclusion

Minimally invasive one-stage flapless technique for the anterior maxillary single-tooth replacement, with immediate non-functional loading, is predictable and successful treatment approach in esthetic zone offering significant benefits to dental implant patients.

**Abstract**
The current trend in dental implantology is to develop techniques that can provide function, esthetics, and comfort with a minimally invasive surgical approach. Minimally invasive one-stage flapless technique in maxillary anterior region is usually considered in conjunction with functional or non-functional immediate loading. In this report, a clinical case of using minimally invasive one-stage flapless technique for maxillary right incisor replacement with immediate non-functional loading is presented. A patient was a 21-year-old male with clinical and x-ray signs of a vertical fracture of the endodontically treated maxillary right incisor. After the tooth extraction, guided bone regeneration procedure was performed to prevent post extraction alveolus collapse and provide a better site for the future implant. After 4 months transmucosal surgical approach was used to insert a tapered implant. Location was determined on the basis of slice ortopantomogram x-rays and surgical drill guide was made for precise definition of implant site and angulation. The implant was immediately restored with final zirconium oxide ceramic abutment and temporary acrylic crown without any occlusal contacts. After a healing period of 6 months, the osseointegration was assessed with resonance frequency analysis (value 75.3) and considered adequate. The implant was then treated with the final fixed prosthetic restoration. The patient exhibited neither clinical nor radiologic complications throughout the 6 months period of clinical monitoring.

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Dental Implantation; Esthetics, Dental; Minimally Invasive Surgical Procedures

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