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CASE REPORT
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Implant Retained Orbital Prosthesis – Case Report

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SUMMARY

Orbital defects after tumor resection (exenteration of orbital content) have been traditionally reconstructed with adhesive-retained craniofacial prostheses, also known as epistheses. The breakthrough in rehabilitation of facial defects with implant-retained prostheses has come with development of modern silicones (vynilpolysiloxane) and bone anchorage called osseointegration. Craniofacial implant technology offers improved reconstructive options to patients. This paper describes therapeutical procedure on a patient who received craniofacial implant-retained orbital prosthesis after orbital exenteration. The patient reported excellent prosthesis handling and stability.

Keywords: craniofacial tumors; orbital exenteration; craniofacial implants; osteointegration; orbital prosthesis; vinylpolysiloxane material

INTRODUCTION

The first facial prostheses (epistheses) made of bee wax have been found in ancient Mesopotamia and Egypt. One of the first documented evidence comes from XVI century, when the French surgeon Ambroise Paré (1510–1590) described first nose prostheses made of gold and silver that were attached to the face by a string tied around the head [1]. He also invented ocular prostheses with artificial eyes made of enameled gold, silver, porcelain and glass. Three centuries later polymethyl metacrylic resin was developed in 1877 by a German chemist Wilhelm Rudolph Fittig (1835–1910) and it was the material of choice for producing not only complete dentures in edentulous patients but also for fabricating facial prostheses. In the second half of the XX century, esthetic quality of facial prostheses has considerably been improved by introducing silicone materials Room Temperature Vulcanization vynilpolysiloxane (RTV). However, the problem of their retention and stabilization, very important for aesthetics and function, has not been entirely solved. Facial prostheses are constructed by prosthodontists and technicians anaplastologist as an alternative treatment when facial defects cannot be surgically reconstructed.

Conventional fixation tools such as skin adhesives and eyeglass frames have become uncomfortable for patients. The revolution in maxillofacial prosthetics happened after discovery of free vascularized flaps (double barrel fibular graft by Katsuhiro Horiuchi, 1995) and craniofacial implants [2]. The first modified extraoral implants (craniofacial implants) for anchorages of auricular prosthesis were placed by professor Per-Ingvar Brånemark in 1979 [3]. To obtain craniofacial osseointegration some important steps had to be taken. Different kinds of implants have been developed. Exraoral implants were made of commercially pure titanium (C.p. Ti) with 3–5 mm long, threaded and machined surface similar as oral implants. It has also been found important to attach a flange in the coronal part of fixture to prevent its dislodgement into the brain by longitudinally directed trauma (Figure 1). This has been shown as safe security measure in trauma cases where only in minor cases fractures of the skull bone could happen but with no severe damage [4]. Osseointegration has been considered as contraindication in irradiated bone; however, it has been found that osseointegrated implants, regardless of used technique are successful in cancer patients. The most common reasons for implant failures in cancer patients are soft tissue dehiscences and osteoradionecrosis [5]. It has been known that irradiated bone heals at slower healing rate but it is still possible to use the concept of osseointegration at slower healing rate. Hyperbaric oxygen therapy (HBO) for prevention of side effects of radiotherapy has also been shown effective [6]. Skin penetration is the factor that has caused the most important clinical problems related to craniofacial osseointegration. Using clinical grading system based on skin condition it is possible to determine adverse skin reactions [7].

Figure 1. Craniofacial implants with flange
Slika 1. Kraniofacijalni impalntati sa graničnikom

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Orbital prosthesis

Eye loss or absence may be caused by congenital defect, trauma, or tumor pathology. Most commonly present tumors in this area are retinoblastoma, followed by squamous cell carcinoma, adenocystic carcinoma, basal cell carcinoma and malignant melanoma [8]. Surgical treatment includes orbital exenteration i.e. removal of the entire orbit, usually involving partial or total removal of eyelids to prevent spreading of malignant cells. Postsurgical appearance of this area can cause significant physical and emotional problems. It is very important to produce an orbital prosthesis as soon as possible after periorbital tissue healing is completed [9]. Prostheses are typically made out of vynilpolysiloxane retained by skin adhesives; however, the use of osseointegrated implants in the craniofacial region reduces adhesives use and offers higher long-term success [10]. Orbital prosthesis retained with craniofacial implants is a method of choice for replacement of hard and soft orofacial tissues. Prosthesis design, shade and texture must blend with surrounding tissues. Post-resection rehabilitation is achieved if patients don't attract unwanted attention at home or in public. An important prerequisite for successful treatment is the presence of stable lateral osseous tissue.

The aim of this study was to demonstrate surgical treatment and prosthetic rehabilitation of a patient using implant retained orbital prosthesis.

CASE REPORT

A 69-year-old male patient was referred to the Clinic of Maxillofacial Surgery, University of Belgrade, with anterior and vertical displacement of the right eye, limitation of motility and pain. A squamous cell carcinoma of the right maxillary sinus was diagnosed and radical maxillectomy and orbital exenteration with removal of eyelids was performed. After the first week of surgical after care the patient was released home with simple band over the area.

The patient also underwent radiotherapy of 65 Gy. Six months after radiotherapy the patient was again referred to the Clinic for insertion of craniofacial implants that will retain orbital prostheses (Figure 2). After proper planning the surgical insertion of craniofacial implants (Ihde Dental, Switzerland) was performed using model based surgical stent (Figure 3). Two implants with screws were placed in supraorbital region laterally due to sufficient bone and acceptable distance from frontal sinus. One additional disc implant was placed in zygomatic region for better stabilization of metal substructure of orbital prosthesis. After the osseointegration period of three months (Figures 4 and 5) orbital prosthesis fabrication was performed at the Department of Maxillofacial Prosthodontics at the Faculty of Dental Medicine in Belgrade.

Accurate impression of orbital defect, periorbital tissue and craniofacial implants position was performed using open individual tray impression technique. Metal transfers were placed on implants and vynilpolysiloxane (VPS) impression material was used. Wide facial impression had purpose to give precise shape of orbital defect and surrounding area. After impression was taken implant analogues were connected to metal transfers and cast was fabricated in hard dental stone. Metal substructure (Co-Cr alloy) with bar clip retention system was fabricated and positioned on the craniofacial implants (Figure 6). The base for the silicone orbital prosthesis was made of acrylic resin as a plate with metal matrices housing placed on the basal side of acrylic plate. The acrylic plate was then positioned on metal substructure on the cast and wax modeling started. After modeling was done, try in was performed. The patient was standing in relaxed position with eye focused in a distant point while the clinician evaluated the position of prosthesis. The next step was shaping the periorbital tissue. Eyelid contours and periorbital tissue simulated normal eye as closely as possible (Figure 7). When completed, the wax model was luted to the front and back of the cast and prepared for processing.

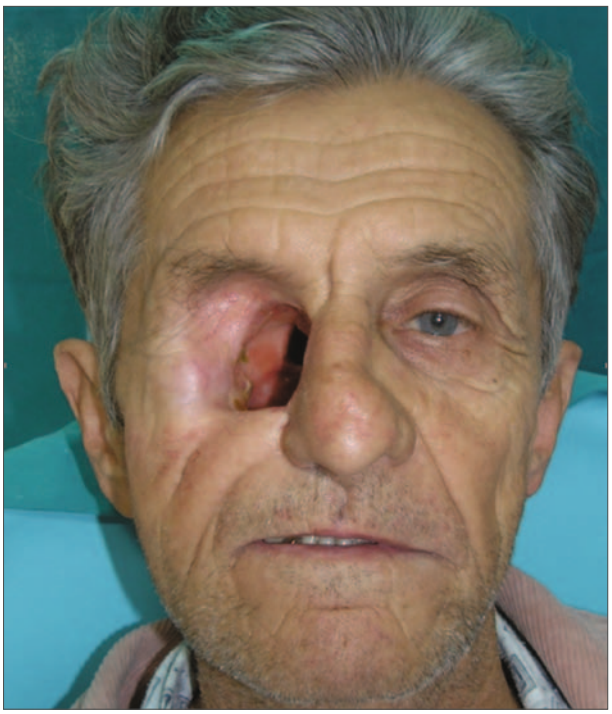

Figure 2. Orbital defect after exenteration
Slika 2. Orbitalni defekt posle egzenteracije

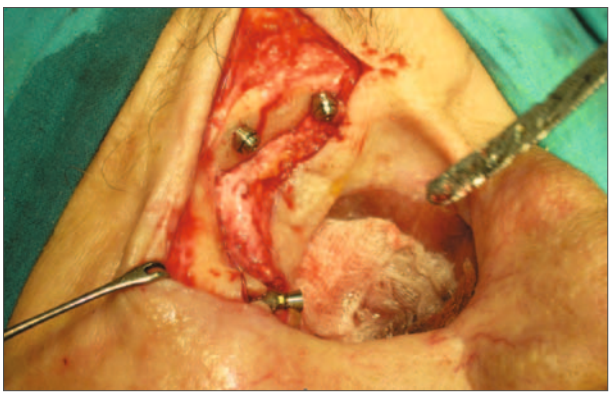

Figure 3. Craniofacial implants placed in supraorbital-lateral and in zygomatic region
Slika 3. Kraniofacijalni implantati ugrađeni supraorbitalno lateralno i u zigomatičnom regionu

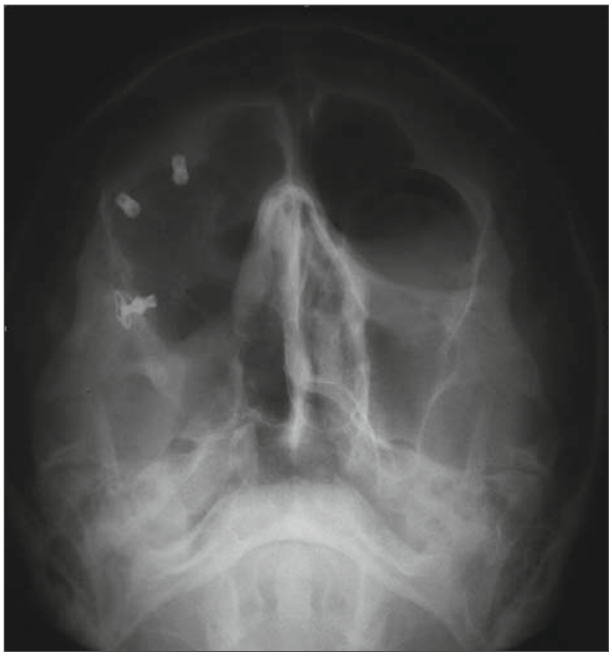

Figure 4. X ray of osseointegrated craniofacial implants
Slika 4. Kontrolni rendgenski snimak oseointegrisanih implantata

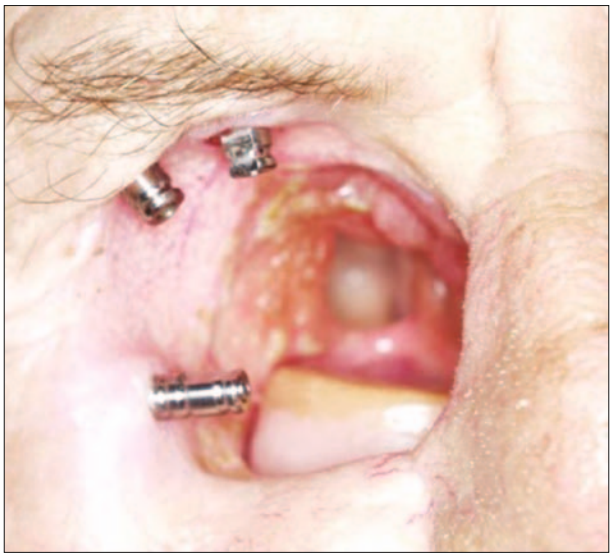

Figure 5. Osseintegrated craniofacial implants
Slika 5. Klinički izgled oseointegrisanih kraniofacijalnih implantata

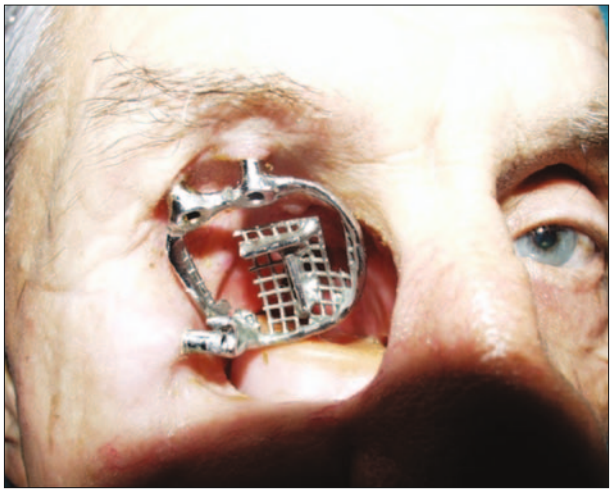

Figure 6. Metal substructure with bar clip retention
Slika 6. Metalna podstruktura sa prečkom

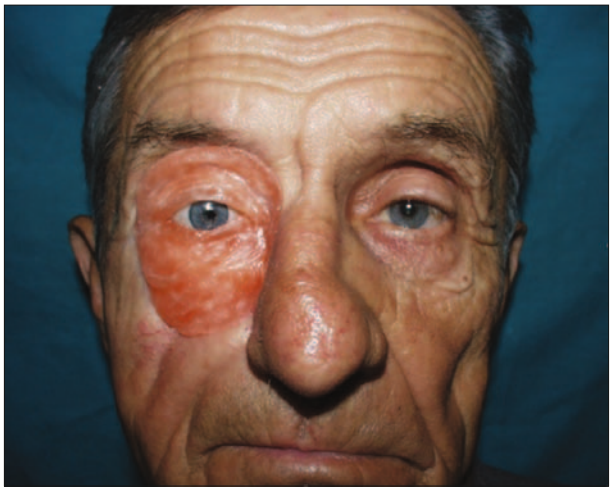

Figure 7. Completed wax sculpting with centered stock eye
Slika 7. Završena modelacija u vosku sa centriranom očnom jabučicom

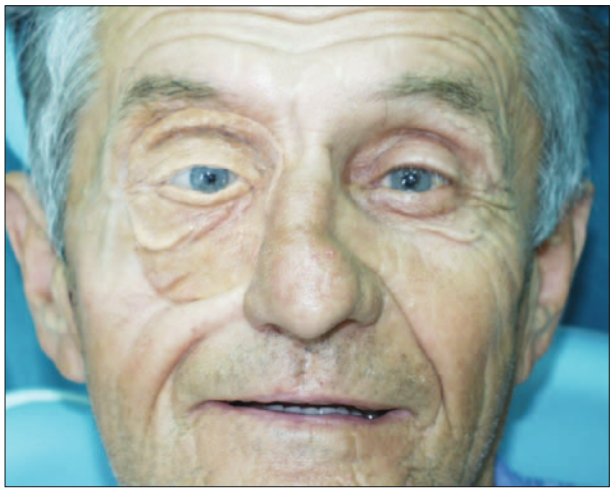

Figure 8. Silicone orbital prosthesis in place
Slika 8. Silikonska orbitalna proteza na pacijentu

Figure 9. Natural look with eyeglass frames to camouflage the prosthesis
Slika 9. Naočare daju prirodniji izgled i kamufliraju ivice proteze

The cast was invested in a flask. After setting the stone wax was removed. Vynilpolysiloxane (VPS) material from Bredent, Germany was used to fabricate the silicone part of the prosthesis. Intrinsic coloration was performed with catalyzed intensive colors in some areas and base color (City shade, Bredent) was injected to fill the rest of the mold. After 24 hour processing the silicone part of prosthesis was completed. Extrinsic colors were added to the surface to complete color characterization. Prosthesis was delivered to the patient (Figures 8 and 9) and he was instructed how to use and take care of prosthesis.

DISCUSSION

Orbital defects are most commonly consequences of tumor pathology, trauma or congenital defects. In many cases reconstructive surgery of soft tissue and eyelids with inserted artificial eye bulb has been cosmetically poor. Therefore, craniofacial orbital prostheses made out of RTV silicon materials have been shown the best possible material for this purpose.

Conventional fixation tools for craniofacial prostheses such as skin adhesives and eyeglass frames were commonly used until 1980's. With discovery of osseointegration concept of dental implants by Brånemark in late 70's a new era for retention and stabilization of facial prostheses has started. Since 1980, osseointegrated craniofacial implants have been widely used for retention of orbital, ear, and nose prostheses. This way of retention reduces skin irritation, both mechanical and chemical, from adhesives or adhesive solvents and allows better stabilization of orbital prostheses. Patients can easily handle implant-retained prostheses, clean the defect and it provides them higher quality of life.

Orbital exenteration due to craniofacial tumor resection is common reconstructive dilemma that often results with long-term patient dissatisfaction. Traditional prosthetic reconstructive options have been centered on adhesive-retained silicone prostheses. Craniofacial implant-retained orbital prostheses offer improved reconstructive options, easy handling and good stability. Also there is significant improvement in patient satisfaction.

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Implantatno retinirana orbitalna proteza – prikaz slučaja

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KRATAK SADRŽAJ

Orbitalna oštećenja nastala resekcijom tumora (egzenteracija sadržaja orbite) se uglavnom rekonstruišu kraniofacijalnim protezama pričvršćenim adhezivima koji se nazivaju i epitezama. Izuzetne mogućnosti u rehabilitaciji defekata lica sa implantatno retiniranim protezama nastale su razvojem savremenih silikona (vinilpolisiloksana) i oseointegracijom implantata. Kraniofacijalna implantatna tehnologija danas pruža široke i poboljšane rekonstruktivne mogućnosti. U ovom radu je opisana terapijska procedura na pacijentu sa defektom orbite gde je izrađena implantatno retinirana orbitalna proteza. Pacijent je posle završene terapije bio zadovoljan zbog jednostavnog rukovanja i izuzetne stabilnosti proteze.

Ključne reči: kraniofacijalni tumori; orbitalna egzenteracija; kraniofacijalni implantati; oseointegracija; orbitalna proteza; vinilpolisiloksan materijal

UVOD

Istorijski posmatrano, prve proteze lica od pčelinjeg voska izrađivane su još u drevnoj Mesopotamiji i starom Egiptu. Međutim, prvi dokumentovani zapisi potiču iz 16. veka od francuskog hirurga Ambroaza Parea (*Ambroise Paré*, 1510–1590), koji je opisao izradu prve proteze nosa od zlata i srebra koje su se pridržavale pomoću kanapa vezanog oko glave [1]. On je takođe izumeo izradu okularnih proteza kod kojih je veštačko oko izrađivano od enameliranog zlata, srebra, porcelana i stakla. Tri veka kasnije nemački hemičar Vilhelm Rudolf Fitig (*Wilhelm Rudolph Fittig*, 1835–1910) je 1877. godine otkrio polimer (polimetilmetakrilat), koji je bio materijal izbora u izradi ne samo totalnih proteza kod pacijenata bez zuba, već se bojeni akrilat koristio i za izradu proteza lica. U drugoj polovini 20. veka je umnogome rešen problem estetske prirode proteza lica pronalaskom RTV silikona (engl. *Room Temperature Vulcanization vynilpolysiloxane*), ali problem njihove retencije i stabilizacije, koji je ključan faktor za estetiku i funkciju, nije bio potpuno rešen. Proteze lica, kao alternativni terapijski postupak, planiraju i konstruišu specijalisti protetike i tehničari anaplastolozi ukoliko nije moguće to rešiti odgovarajućom hirurškom rekonstrukcijom oštećenja lica.

Klasičan način retiniranja proteza lica adhezivima i pomoću okvira naočara postalo je nekomforno za pacijente. Revolucionarni prodor u maksilofacijalnoj protetici nastao je pre četvrt veka otkrićem slobodnih vaskularizovanih režnjeva (dupli režanj fibule, Kacuhiro Horiuči, 1995) i kraniofacijalnih implantata [2]. Prve modifikovane ekstraoralne implantate (kraniofacijalne implantate) za retenciju aurikularne proteze ugradio je 1979. godine profesor Per-Ingvar Branemark (*Brånemark*) [3]. Da bi se razvio odgovarajući koncept kraniofacijalne oseointegracije, koji bi dao pozitivne kliničke rezultate, trebalo je načiniti nekoliko važnih koraka. Najpre je razvijeno nekoliko vrsta implantata koji su se razlikovali od onih za primenu u usnoj duplji. Izrađivani su od komercijalno čistog titana (C.p. Ti), generalno su bili uži i dužine 3–5 mm, i uglavnom sa frezovanim navojima i mašinski obrađenom površinom kao i kod oralnih implantata. Tek kasnije je dodat graničnik u vratnom delu implantata, kako bi se posle longitudinalno usmerene traume na implantat sprečila intruzija implantata u lobanjski prostor (Slika 1). Ovaj dizajn implantata se pokazao sigurnim u slučajevima povrede, gde je samo u manjem broju dolazilo do preloma kosti lobanje i neznatnih problema [4]. U početku se smatralo da je oseointegracija u zračenoj kosti ugrožena, ali ipak pacijenti s kraniofacijalnim tumorom mogu imati mnogo koristi od oseointegrisanih implantata bez obzira na primenjenu tehniku njihove ugradnje. Vremenom je, nažalost, dolazilo do većeg gubitka implantata kod ove populacije i pojave dehiscencije mekog tkiva i neželjene osteoradionekroze [5]. Proučavajući zračenu kost, došlo se do saznanja da ona znatno sporije zarasta, te se na osnovu te činjenice koncept oseointegracije ipak mogao koristiti pod određenim uslovima dužeg oporavka tkiva posle zračenja. U takvim slučajevima se preporučuje terapija u hiperbaričnoj komori, kako bi se sprečile nuspojave zračne terapije koje mogu pogoršati oseointegraciju [6]. Penetracija kože je faktor koji takođe može ugroziti oseointegraciju kraniofacijalnih implantata i zato se mora uzeti u obzir klinička gradacija stanja kože, kao i moguća reakcija kože u takvim situacijama [7].

Orbitalne proteze

Gubitak ili nedostatak sadržaja očne duplje može biti kongenitalne prirode, zatim posledica povrede ili tumorske patologije. Najčešći tumori orbite su retinoblastomi, skvamozno-celularni karcinomi, adenocistični karcinomi i drugi, kao što su bazalni karcinomi i maligni melanomi [8]. Hirurško lečenje se ogleda u orbitalnoj egzenteraciji, tj. uklanjanju sadržaja cele orbite, uključujući delimično ili potpuno uklanjanje kapaka i sprečavanje dalje eradijacije malignog orbitalnog tumora. Izgled postresekcionog oštećenja može da izazove kako fizičke, tako i emocionalne probleme pacijenata. Veoma je važno izraditi orbitalnu protezu odmah nakon zarastanja periorbitalnih tkiva [9]. Proteze se uglavnom u poslednje vreme izrađuju od vinilpolisiloksana i pričvršćuju adhezivima za kožu, ali primena oseointegrisanih implantata u kraniofacijalnom regionu je terapijska opcija koja smanjuje ograničenja vezana za adhezive i koja ima dugoročan uspeh [10]. Orbitalne proteze retinirane kraniofacijalnim implantatima su metoda izbora u nadoknadi tvrdih i mekih orofacijalnih struktura. Oblik proteze, boja i tekstura moraju biti što je moguće približnije zdravom delu lica. Rezultati postresekcione rehabilitacije mogu biti uspešni jedino ako pacijent u porodici i javnosti ne privlači neželjenu pažnju.

Važan preduslov za uspeh terapije orbitalnim protezama retiniranim kraniofacijalnim implantatima je postojanje kvalitetnog koštanog tkiva u supraorbitalnom lateralnom regionu.

Cilj ovog rada je da se na primeru iz kliničke prakse prikaže hirurški i protetički postupak izrade implantantno retinirane orbitalne proteze.

PRIKAZ BOLESNIKA

Muškarac star 69 godina javio se na Kliniku za maksilofacijalnu hirurgiju Univerziteta u Beogradu sa anteriorno i vertikalno pomerenom desnom očnom jabučicom, ograničenim pokretima i bolnim senzacijama. Dijagnostikovan je skvamozno-celularni karcinom iz desnog gornjoviličnog sinusa i izvršena resekcija desne maksile, kao i radikalna orbitalna egzenteracija s potpunim uklanjanjem oba kapka desnog oka. Nakon prve nedelje postoperacionog oporavka bolesniku je postavljen zavoj i otpušten je kući.

Zbog prirode reseciranog tumora bolesnik je podvrgnut zračnoj terapiji u visini od 65 Gy. Šest meseci od prestanka zračne terapije bolesnik je ponovo primljen na istu kliniku radi ugradnje oseointegrisanih implantata za retenciju orbitalne proteze (Slika 2). Urađeno je najpre detaljno planiranje ugradnje implantata, a potom su hirurški postavljena tri implantata (*Ihde Dental*, Švajcarska) korišćenjem hirurškog stenta (Slika 3). Dva kraniofacijalna implantata s navojima su ugrađena u supraorbitalni region lateralno zbog dovoljne količine i gustine kosti, a i čeoni sinus je dovoljno udaljen, dok je dodatni disk-implantat ugrađen u zigomatičnu kost zbog bolje stabilizacije metalne podstrukture orbitalne proteze. Posle perioda oseointegracije u trajanju od najmanje tri meseca (Slike 4 i 5) započeta je izrada orbitalne proteze na odeljenju maksilofacijalne protetike Stomatološkog fakulteta Univerziteta u Beogradu.

Za otisak orbitalnog defekta i periorbitalnih tkiva, kao i za tačan prenos položaja kraniofacijalnih implantata, korišćena je tehnika otiskivanja otvorenom individualnom kašikom. Najpre su postavljeni metalni transferi na implantate, a zatim je korišćen adicioni vinilpolisiloksan otisni materijal. Otisnuta je šira površina lica radi dobijanja što preciznijeg oblika defekta s okolnim tkivima i strukturama. Posle vezivanja otisnog materijala otisak je uklonjen, postavljeni su analozi implantata i izliven je model od tvrdog gipsa. Potom je izrađena metalna podstruktura proteze s prečkom od legure kobalta i hroma (Co-Cr) i pozicionirana na kraniofacijalne implantate (Slika 6).

Osnova orbitalne proteze od silikona izrađena je od polimetilmetakrilata u vidu ploče, u čiju bazalnu stranu su ugrađena metalna kućišta za matrice. Akrilatna ploča je potom pozicionirana na metalnu podstrukturu i postupak modelovanja je započet. Potom je ceo sistem prenošen s modela na bolesnika, tako da stoji uspravno u relaksirajućem položaju s pogledom zdravog oka pravo, kako bi terapeut mogao pravilno da centrira veštačku očnu jabučicu. Kada je završeno centriranje očne jabučice koje je prihvatljivo, nastavljeno je sa daljom modelacijom periorbitalnih tkiva u vosku. Konture kapaka i periorbitalnih tkiva u vosku treba da simuliraju one na zdravom oku što je moguće približnije (Slika 7). Kada je u celosti završena modelacija u vosku, same ivice proteze su zalivene voskom za rub modela i time je objekat pripremljen za izradu kalupa. Kalup je izrađen od tvrdog gipsa i posle stvrdnjavanja vosak je uklonjen iz kalupa, a položaj očne jabučice dodatno osiguran. Za izradu silikonskog dela proteze korišćen je vinilpolisiloksan (*Bredent*, Nemačka). Unutrašnje bojenje silikona vršeno je katalizirajućim intenzivnim bojama prema boji kože bolesnika koje su nanesene na željene delove kalupa, dok je masa sa svetlijom osnovnom bojom (*City Shade*, *Bredent*, Nemačka) ubrizgana u ostatak kalupa. Posle 24 sata proces polimerizacije silikona na sobnoj temperaturi je završen. Zatim je proteza obojena sa spoljne strane radi individualne karakterizacije osnovne boje. Gotova proteza je predata bolesniku (Slike 8 i 9) uz savete o održavanju proteze i o tome kako da okrene glavu i usmeri pogled napred sa zdravim okom a ne sa veštačkim u protezi.

DISKUSIJA

Orbitalna oštećenja su najčešće prouzrokovana tumorskom patologijom, povredom ili mogu biti kongenitalne prirode. U mnogim slučajevima postupci rekonstruktivne hirurgije mekog tkiva i kapaka s insertovanom veštačkom očnom jabučicom nisu dali zadovoljavajuće estetske rezultate. U takvim situacijama najbolje je protetičko rešenje s kraniofacijalnim orbitalnim protezama izrađenim od vinilpolisiloksana (RTV silikona).

Klasičan način retencije kraniofacijalnih proteza je decenijama bio adheziv za kožu ili okvir naočara do osamdesetih godina prošlog veka. S pronalaskom koncepta oseointegracije dentalnih implantata kasnih sedamdesetih godina započeta je nova era u maksilofacijalnoj protetici za retenciju i stabilizaciju facijalnih proteza. Već od 1980. godine oseointegrisani kraniofacijalni implantati se široko koriste za retenciju proteza oka, uva i nosa. S ovim načinom retencije proteza mogućnost mehaničke ili hemijske iritacije kože usled adheziva ili njihovih rastvarača su rešene, a istovremeno se postiže mnogo bolja stabilizacija. Pacijenti jednostavno rukuju implantatno retiniranom protezom i lako čiste defekt, što predstavlja značajno poboljšanje kvaliteta života pacijenata s oštećenjem orbite i periorbitalnog tkiva.

Resekcija kraniofacijalnih tumora s egzenteracijom sadržaja orbite uglavnom je dilema za hirušku rekonstrukciju, koja često dovodi do nezadovoljstva pacijenata zbog loših kozmetičkih rezultata. Protetička rekonstrukcija u kombinaciji s adhezivima daje bolje estetske rezultate, ali i bolju retenciju silikonskih epiteza. Pacijenti jednostavno rukuju ovakvim protezama, a njihova stabilnost je takođe značajno poboljšana. Ova činjenica predstavlja značajnu satisfakciju pacijenata, ali i poboljšanje njihovog psihosocijalnog statusa s obzirom na prirodu oštećenja na njihovom licu.