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Presadivanje kosti u alveolarni greben pacijenta s rascjepom: od koštanog defekta do zubnih implantata

Alveolar Bone Grafting in Cleft Patients: from Bone Defect to Dental Implants

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Sažetak

Rascjep usne i nepca najčešći je prirodni deformitet kraniofacijalne strukture. Orofacijalni rascjep znatno utječe na kvalitetu života – na estetiku, funkciju te na dentalni razvoj i rast lica, a ima i psihološki učinak. Glavni razlog za njegov nastanak jest nekompletno spajanje facijalnih nastavaka od četvrtog do desetog tjedna gestacije. Zatvara se alveolarnim koštanom presatkom kirurškim postupkom nazvanim *osteoplastika*, a *zlatnim standardom* smatra se autogena kost s kriste ilijake. Presadivanje može biti podijeljeno u dvije faze: primarnu i sekundarnu. Defekt alveolarnog grebena obično se rekonstruira između sedme i jedanaeste godine i često je povezan s razvojem korijena maksilarnog ocnjaka. Nakon uspješnog zahvata defekt rascjepa je zatvoren, ali nedostaje zub. Zatvaranje toga prostora ortodontskom terapijom uspješno je u 50 do 75 posto slučajeva. Ako to nije moguće, zub koji nedostaje može se nadomjestiti na tri načina: protetskim mostom, transplantacijom zuba i dentalnim implantatom. Dentalnom je implantatu zadatak držati protetski nadomjestak, prevenirati atrofiju kosti i zadržavati augmentacijski materijal u području rascjepa. Unatoč tomu što je autologna kost s kriste ilijake *zlatni standard*, nije idealni izbor za rekonstrukciju alveolarnog defekta. Kao alternativni koštani materijal može se upotrijebiti morfogenetski protein (BMP). U ovom članku želi se objasniti morfologija rascjepa, povijesna saznanja, kirurške tehnike i mogućnosti implantoprotetske rehabilitacije.

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Uvod

Rascjep usne i nepca najčešći je prirodni deformitet kraniofacijalne strukture. Prevalencija ovisi o populaciji – najveća je kod Indijanaca i autohtonih Amerikanaca među kojima rascjep imaju tri do četiri djeteta na tisuću rođenih. Kod pripadnika bijele rase, rascjep se pojavljuje kod jednog do dva djeteta na tisuću rođenih (1,2). Muški spol češće pati od rascjepa usne i nepca, a izolirani rascjep nepca uglavnom zahvaća žensku populaciju (3). Orofacijalni rascjep znatno utječe na kvalitetu života – na estetiku i funkciju te na dentalni razvoj i rast lica, a ima i psihološki učinak.

Nekompletno spajanje facijalnih nastavaka od četvrtoga do desetog tjedna gestacije glavni je razlog za nastanak rascjepa

Introduction

Cleft lip and palate is the most common congenital deformity affecting craniofacial structures. Prevalence depends on population, therefore it is the highest in Indians and Native Americans where 3–4 children per 1000 births have cleft defect, whereas in Caucasians, cleft defect affects 1–2 newborns per 1000 births (1, 2). Males more often have cleft lip and palate, while isolated cleft palate occurs more frequently in females (3). Orofacial clefts have great impact on the quality of life which includes aesthetics, function, psychological impact, dental development and facial growth.

Incomplete fusion of facial prominences during the fourth to tenth week of gestation is the cause of clefts. De-

pa. Ovisno o tipu nastavka koji je zahvaćen, postoje rascjepi primarnog i sekundarnog nepca. Rascjep primarnoga nepca uključuje rascjep usne, alveolarnog grebena i mali dio tvrdog nepca, a rascjep sekundarnog nepca zahvaća ostatak tvrdog i mekog nepca od foramena incizivuma (4). Etiologija deformiteta je multifaktorijska i povezana s okolišnim i genskim čimbenicima (5).

Već dugo jedna faza kirurškog liječenja pacijenta s orofacijalnim rascjepom uključuje sekundarni koštani presadak (6) s autolognom kosti (7). Ova vrsta koštanog presatka osigurava bitne osteogene stanice i osteoinduktivne čimbenike potrebne za koštano cijeljenje i regeneraciju. Donorsko mjesto može biti krista ilijaka, simfiza mandibule, rebro, tibija ili kalvarija (8). *Zlatni standard* je kost uzeta s kriste ilijake tradicionalnim pristupom ili minimalno invazivnom operacijom (9 – 11). Rascjep alveolarnog grebena obično se rekonstruira između sedme i jedanaeste godine i povezan je s razvojem korijena maksilarnog očnjaka (12, 13). Precious (14) sugerira malo mlađu dob kako bi se poboljšala duljina krune zuba i parodontno stanje. Nekoliko je ciljeva i koristi od koštanoga presatka:

- sačuvan je kontinuitet maksilarnog luka;
- postignuta je maksimalna potpora denticije s pomoću kosti;
- stabiliziran je maksilarni segment poslije ortodontskog liječenja, posebice mobilno primarno nepce pri bilateralnom rascjepu;
- uklonjena je oronazalna fistula;
- nosna hrskavica dobiva potporu;
- uspostavlja se idealna morfologiju alveolarnog grebena;
- stvaraju se uvjeti u obliku kosti i mekoga tkiva za budući smještaj implantata ako ima dovoljno mjesta između susjednih zuba (15 – 17).

Namjera ovoga preglednog članka jest objasniti morfologiju rascjepa, povijesna saznanja, kirurške tehnike i mogućnosti implantoprotetske rehabilitacije.

Obilježja facijalne morfologije i rasta kod pacijenata s rascjepima

Liječenje rascjepa obično počinje tri mjeseca nakon rođenja, traje kontinuirano tijekom cijelog razdoblja rasta i razvoja i često završava početkom zrelosti (18). Anatomske kontinuitet struktura lica i normalno funkcioniranje zahtijevaju suradnju maksilofacijalnog kirurga, ortodonta, logopeda, otorinolaringologa, pedijatra, oralnog kirurga i stomatologa (19 – 21).

Unilateralni potpuni rascjep uključuje rascjep usne i alveolarnog nastavka sve do foramena incizivuma i dijeli maksilu i usnu na dva dijela. Filtrum i intermaksilarna kost, kao veći dio, pomaknuti su naprijed na suprotnu stranu i prema gore (22). Manje razvijeni dio pomaknut je straga pa alveolarni greben ima prekinutu odontogenezu koja u većini slučajeva uključuje lateralni sjekutić. Sjekutići i očnjaci abnormalnoga su oblika i položaja.

U bilateralnim rascjepima, medijalni dio nazvan *prolabium*, nema mišića i skraćen je u vertikalnoj dimenziji. Ovaj oblik rascjepa sastoji se od triju dijelova: dvaju lateralnih i jednoga medijalnog. Lateralni dijelovi smješteni su straga i

pending on which type of prominence is affected, there are clefts including primary and secondary palate. Cleft of the primary palate includes cleft of the lip, alveolus and small part of hard palate, while cleft of the secondary palate includes cleft of the rest of hard and soft palate from the incisal foramen (4). The etiology of deformity is multifactorial, associated with environmental and genetic factors (5).

For many years one stage of surgical treatment for patients with orofacial clefts includes secondary alveolar bone grafting (6) with autologous bone (7). This type of bone graft provides essential osteogenic cells as well as osteoinductive factors needed for bone healing and regeneration. Donor site may be the patient's iliac crest, mandibular symphysis, rib, tibia and calvarium (8). The gold standard is bone from iliac crest, taken by traditional approach or by minimally invasive surgery (9-11). The alveolar cleft is usually reconstructed between 7 and 11 years of age and is often related to the development of the maxillary canine root (12, 13). Precious (14) suggests a slightly younger age to improve the crown length and periodontal condition. There are several objectives and benefits of bone grafting:

- to obtain maxillary arch continuity;
- to maximize bone support for the dentition;
- to stabilize the maxillary segments after orthodontic treatment, especially the removable primary palate of bilateral clefts;
- to eliminate oronasal fistulae;
- to provide nasal alar cartilage support;
- to establish ideal alveolar morphology; and
- to provide available bone with attached soft tissue for future endosteal implant placement in cases where there is a residual dental space (15-17).

The purpose of this review is to explain morphology of cleft defects, historical perspective, surgical techniques and possibilities of implant and prosthodontic rehabilitation.

Characteristics of facial morphology and growth in cleft patients

The treatment of clefts usually begins three months after birth, continuously throughout the whole developmental period and often ends in adulthood (18). The anatomical continuity of facial structures and normal functioning requires a cooperation of a maxillofacial surgeon, orthodontist, phoniatric specialist, otolaryngologist, speech therapist, pediatrician, oral surgeon and dentist (19-21).

Unilateral complete cleft involves cleft gap of the lip and alveolar process up to the incisor foramen and dividing maxilla and lip into two parts. The philtrum and the intermaxillary bone, as the larger part, are moved towards the contralateral side and upwards (22). The less developed part is moved backwards and the alveolar ridge has disturbed odontogenesis, which in most cases affects second incisors. Incisors and canines have abnormal shape and position.

In bilateral cleft, the medial part called *prolabium* is without muscle and shortened in the vertical dimension. This type of cleft has three parts: two lateral and one medial. Lateral parts are positioned backwards and upwards, while

gore, a medijalni dio mobilan je i protrudiran anteriorno te građen od hipoplastične intermaksilarne kosti. U većini slučajeva pojavljuje se oronazalna fistula i patološki povezuje usnu šupljinu i nosni prostor.

Praznine nastale rascjepom zatvaraju se alveolarnim koštanim presatkom kirurškim postupkom nazvanim osteoplastika. Autogena kost uzima se kao *zlatni standard* s kriste ilijake. Vrijeme presađivanja može biti podijeljeno u dvije faze: primarnu i sekundarnu. Razlika je u tome što se primarni presadak ugrađuje poslije operacije usne, a prije operacije nepca (23, 24). Sekundarni presadak može biti definiran kao rani od dvije do pet godina, rani s mješovitom denticijom od šest do osam godina, kasni s mješovitom denticijom od devet do dvanaest godina i kasni sekundarni presadak ako se ugrađuje nakon 13. godine (25, 26).

Povijest kirurškog postupka

Lexer (1908.) i Dratcher (1914.) prvi su uspješno obavljali koštano presađivanje kod pacijenata s rascjepima (27). Poslije toga su primarni alveolarni koštani presadak prvi put spomenuli Schrudde i Stellmach, a u izvješćima o rezultatima liječenja iz 1960-ih ističu se velike teškoće u maksili kao posljedica primarnoga koštanog presatka (28). Brauer i suradnici omogućili su vrijedan uvid u ono što kirurzi i ortodonti nastoje postići s primarnim alveolarnim koštanim presatkom. Navode kako u slučaju unilateralnog rascjepa nedostatak kosti i mekog tkiva te povlačenje reparirane usne na zdravu stranu, rezultira ravnanjem i retruzijom srednje trećine lica (29). Također smatraju da se ranom operacijom stvara most koji dopušta retrudiranoj strani maksile zahvaćenoj rascjepom normalan rast s manje hipoplazije. Za bilateralni deformitet skupina autora (30) navodi da se premaksilarni segment premošćuje s pomoću kosti i spaja s maksilarnom komponentom. Takav pristup primjenjivao se i tijekom 1970-ih u mnogim razvijenim zemljama svijeta. Sekundarni koštani presadak prvi su 1972. godine predstavili Boyne i Sands, a rezultate je prezentiralo nekoliko autora (31 – 33). Otkrili su, kao i Millard u svojim istraživanjima (34), da trajna stabilizacija maksilarnih segmenata nije rezultat ranoga koštanog presatka koji uzrokuje malookluziju i restrikciju rasta. Sekundarni alveolarni koštani presadak ima dvije prednosti – omogućuje koštanu potporu nicanju zuba i stabilizira maksilu. Obično se ugrađuje u razdoblju mješovite denticije prije nicanja očnjaka kako bi taj zub mogao niknuti u čvrstu kost i ojačati stabilizaciju maksile (35, 36).

Kirurške tehnike

Osteoplastika rascjepa (slika 1., 2.) obavlja se u općoj endotrahealnoj anesteziji uz intravensku antibiotsku profilaksu (amoksicilin + klavulanska kiselina). Autogena spongiozna kost struže se s prednje kriste ilijake. Zbog toga se mora učiniti rez od dva centimetra otprilike centimetar lateralno od posteriorne kriste ilijake prema anteriornoj. Incizija se radi kroz sve slojeve kože do insercije *oblique fascia*, no posebna se pozornost mora obratiti na okolno mišićno tkivo. Površinski sloj kosti – periost, mora se oštro zarezati kako bi se ogo-

medial part is protruded anteriorly and mobile, formed by the hypoplastic intermaxillary bone. Vestibulo-nasal fistula is visible in large amount of cases and constitutes a pathological junction between the oral vestibule and nasal cavity.

Cleft gaps are closed with alveolar bone grafts in surgical procedure called osteoplasty. Autogenic bone is taken from the iliac crest as the gold standard. The time of grafting can be divided into two stages: primary and secondary. The difference is that primary grafting is made after lip repair but before repair of the palate (23, 24). Secondary grafting has been defined as early secondary at 2-5 years, early mixed dentition at 6-8 years, late mixed dentition at 9-12 years, and late secondary grafting if done after the age of 13 (25, 26).

History of surgical procedure

Lexer (1908) and Dratcher (1914) made first successful attempts of bone grafting in patients with clefts (27). After that, primary alveolar bone grafting was first mentioned by Schrudde and Stellmach, and in 1960's reports of treatment results have shown great growth disturbances in the maxilla as a result of primary bone grafting (28). In 1962, Brauer et al. provided valuable insight into what surgeons and orthodontists were trying to achieve with primary alveolar bone grafting. They stated that in the unilateral cleft, the absence of bone and soft tissue, as well the pull of the repaired lip on the noncleft side, results in flattening and retrusion of the middle face (29). They believed that early repair of the unilateral alveolar cleft provided a bridge which would allow the retruded cleft-sided maxilla to grow normally and with less hypoplasia. In bilateral deformity some authors (30) stated that premaxillary segment was being bridged to stabilize premaxillary and maxillary components. This approach of early primary bone grafting continued throughout the 1970s in many parts of the developed world.

Secondary bone grafting was introduced by Boyne and Sands in 1972, and those results were presented by several authors (31-33). They found out that permanent stabilization of maxillary segments did not result from early bone grafting which causes malocclusion and growth restriction, which is similar to the findings of Millard (34). Secondary alveolar bone grafting has two benefits such as bony support for tooth eruption and stabilization of the maxilla. It is usually performed during the period of mixed dentition before eruption of the canine therefore it can erupt into solid bone and enhance stabilization of the maxilla (35, 36).

Surgical technique

Osteoplasty of alveolar cleft (Figure 1, 2) is performed with prophylactic antibiotics (amoxicillin/clavulanic acid) given intravenously to prevent infections and under general endotracheal anesthesia. Autogenic spongy bone is harvested from the anterior iliac crest. A skin incision is placed approximately 1 cm laterally to the iliac crest posterior to the anterior superior iliac spine and is about 2 cm long. The incision is made through all parts of the skin to the insertion of the oblique fascia on the crest, with special attention di-



Slika 1. Ortopantomogram prije sekundarnoga alveolarnog koštanog presađivanja kod 11-godišnjeg pacijenta s unilateralnim rascjepom usne i nepca

Figure 1 Panoramic radiograph before secondary alveolar cleft bone grafting of 11-year old patient with unilateral cleft lip and palate

Slika 2. Intraoralna slika prije osteoplastike

Figure 2 Intraoral image before osteoplasty

Slika 3. Otvoreni segment kriste ilijake

Figure 3 A segment of iliac crest expose

Slika 4. Incizija i podizanje reznja tijekom sekundarnoga koštanog presađivanja

Figure 4 Incision and flap elevation for secondary alveolar bone graft

Slika 5. Sastrugana spongiozna kost

Figure 5 Cancellous bone harvested

Slika 6. Smješteni koštani presađak tijekom sekundarnog presađivanja

Figure 6 Graft placement during secondary alveolar bone grafting

Slika 7. CT bilateralnoga rascjepa prije osteoplastike za postavljanje implantata

Figure 7 CT scan of patient with bilateral cleft lip and palate before osteoplasty

Slika 8. Autologni koštani presađak pričvršćen vijcima pri bilateralnom rascjepu

Figure 8 Autologous bone graft fixed with screws in bilateral cleft

Slika 9. Dentalni implantati smješteni u prostor rascjepa

Figure 9 Dental implants positioned in cleft gaps

Slika 10. Završna protetska rehabilitacija s implantatima i krunicama

Figure 10 Final prosthodontic rehabilitation with implants and crowns

lio segment kriste ilijake. Osteotomom se učine dva poprečna horizontalna reza kako bi se sačuvao blok kortikalne kosti i smanjila opasnost od perforacije peritoneja. Kiretama se koristimo kako bismo sastrugali odgovarajuću količinu spongiozne kosti (slika 3.). Kod djece je i skalpel dovoljan da bi se podignuo kortikalni, a spongiozna kost može se lako sastrugati kohlejom. Nakon toga se kirurška rana ispere, napuni mikrofibrilarnim kolagenom (Surgicel, Ethicon Inc., SAD) kako bi se postigla hemostaza i zatvori u slojevima. Nikakva drenaža ni pritisak nisu potrebni.

Područje rascjepa infiltrira se s 1-postotnim ksilokainom s adrenalinom na palatinalnoj i vestibularnoj strani maksile. Duž ruba rascjepa oblikuju se dva mukoperiostna reznja pune debljine (slika 4.). Mukoza nosa odvaja se incizijom od gingive na objema stranama maksile. Reznjevi se podižu vrlo oprezno periostnim podizačem duž labijalne površine alveolarnog nastavka do aperture piriformis. Zatim se mukozna nosa iz područja rascjepa podigne prema nosnoj šupljini kako bi se nova kost smjestila u prazan prostor. Autogenom kosti popunjava se pukotina rascjepa (slika 5.) i pokrije podignutim reznjem. Incizija mukoznog reznja za pokrivanje rascjepa može biti pomaknuta s lateralne strane alveolarnog nastavka (37). Koštani presadak preporučuje se smjestiti u područje aperture piriformis (slika 6.) kako bi se podignula i poduprla baza nosa na strani rascjepa. Na slici 7. prikazan je CT obostranoga rascjepa nakon sekundarne osteoplastike koja nije rezultirala dovoljnim volumenom kosti za postavljanje implantata. Koštani presadak sa stražnjega dijela *lineae obliquae* mandibule može se uzeti u bloku i pričvrstiti vijcima (slika 8.). Operacijsko područje zatvara se reznjem i osigura resorbirajućim šavovima. Preporučuju se analgetici te se pacijentima i njihovim roditeljima daju upute o oralnoj higijeni.

Implantoprotetska rehabilitacija

Kod pacijenata s rascjepima veća je incidencija anomalija zuba nego u nezahvaćenju populaciji. U području rascjepa mogu se pojaviti mnoge teškoće s denticijom, poput impaktiranih zuba, ageneze i prekobrojnih zuba, zakašnjeloga razvoja zuba i promijenjenih odnosa krune zuba i korijena (38 – 41). Poslije uspješne osteoplastike defekt se zatvara, ali nedostaje zub. U većini slučajeva to je lateralni sjekutić. Zavarivanje prostora ortodontskim liječenjem uspješno je u 50 do 75 posto slučajeva (42, 43). Ako ortodontski tretman nije moguć, tri su mogućnosti za nadomještanje zuba: protetski most, transplantacija i implantat. Moderne adhezivne tehnike, i samim time smanjeni utjecaj karijesa, glavni su razlozi za ovakvu vrstu terapije kod adolescenata (44). Donji pretkutnjak najčešći je zub izbora za transplantaciju i mnogobrojnim je pacijentima uspješno presađen na mjesto rascjepa (45).

Kako bi se stvorili bolji osteokonduktivni uvjeti i smanjila resorpcija autolognih presađaka, koštano presađivanje dopunjuje se Bio-Oss materijalom (Geistlich Pharma North America Inc., SAD) (46). To je biološki proizvod s jednakim kemijskim i fizičkim svojstvima kao ljudska kost, ali dobiven od govoda. Kristalna struktura matrice omogućuje dobru stabilizaciju i potporu revaskularizaciji presatka. Autogeni ko-

rected to the surrounding musculature. The underlying periosteum is sharply incised, exposing the segment of the iliac crest. An osteotome makes two perpendicular horizontal cuts to obtain a block of corticocancellous bone and to minimise risk of peritoneal penetration. Curettes are used to harvest the desired amount of cancellous bone (Figure 3). In children even a scalpel is sufficient to lift the part of iliac bone and the cancellous bone is exposed, which can be easily taken with cochlea. The surgical wound is irrigated, filled with microfibrillar collagen (Surgicel, Ethicon Inc., USA) to achieve hemostasis and closed in a layered shape. No drain or pressure dressing is used.

The cleft area is infiltrated with 1% xylocaine with epinephrine on the palatal and buccal site of the anterior maxilla. Two full-thickness mucoperiosteal flaps are created by incising the anterior surface of the alveolar process, alongside the cleft ridge (Figure 4). The nasal mucosa is separated by an incision from the gingiva on the both sides of maxilla. Flaps are lifted cautiously with a periosteal elevator along the labial surface of alveolar process to the piriform aperture. The nasal mucosa is reflected into the nose and the periosteum out of the cleft so that new bone could be grafted. The autogenic bone fills the cleft fissure (Figure 5) and it is covered with lifted flaps. The incision of mucous flap for covering clefts can be moved from the lateral sides of the alveolar process (37). It is advised to place the bone graft in the region of the piriform aperture (Figure 6) to provide elevation and support for the base of ala nasi on the cleft. Bone graft could be taken in a block and fixed with screws (Figure 7, 8). The operation area is closed with a flap and secured with resorbable suture.

Medications are used to achieve postoperative analgesia and instructions for oral hygiene are given to patients and their parents.

Implant and prosthodontic rehabilitation

In cleft patients there is a higher incidence of dental anomalies than in the unaffected population. The cleft area creates many disturbances in the dentition such as impacted teeth, tooth agenesis, supernumerary teeth, delayed dental development and altered crown to root ratios (38-41). After a successful osteoplasty, cleft defect is closed but there is a lack of tooth. In most cases it is the lateral incisor. The space closure with orthodontic treatment has 50-75 % success (42, 43). If orthodontic treatment is not possible, in order to replace the missing tooth there are three possibilities: adhesive bridgework, tooth transplantation and implants. Modern adhesive techniques and reduced caries rates are the main reasons for adhesive bridgework in the adolescent (44). The lower premolar is the most common tooth for transplantation and this has been demonstrated in grafted sites in cleft patients (45).

Positioned upright to create better osteoconductive conditions and to reduce resorption of the autologous graft, bone grafting is carried out with the use of Bio-Oss biomaterial (Geistlich Pharma North America Inc., USA) (46). It is a biological product with the same chemical and physical structure as a human bone, but prepared from the bovine. The crystalline structure of the matrix provides good

štani presadak s plazmom bogatom trombocitima i goveđim bioapatitom često se primjenjuje u implantologiji (47). U vođenoj koštanoj regeneraciji za sprječavanje urastanja vezivnoga tkiva u prazninu u kosti upotrebljavaju se resorbirajuće kolagene membrane (Bio Gide, Geistlich Pharma North America Inc., SAD; Ossix, OraPharma Inc., SAD) (48).

Dentalni implantati (slika 9.) imaju ulogu držača protetškog nadomjestka, preveniraju atrofiju kosti i zadržavaju augmentacijski materijal u području rascjepa. Bezubi prostor može biti mali zbog kirurškoga i ortodontskog liječenja koje rezultira smanjenjem kosti u vertikalnoj i sagitalnoj dimenziji. Meko tkivo oko rascjepa često je ožiljkasto pa je u nekim slučajevima potrebna periimplantatna rekonstrukcija.

U literaturi postoji samo nekoliko članaka o implantološkom liječenju rascjepa. Landes (49) u svojem istraživanju ističe da je vjerojatnost uspjeha pri postavljanju implantata pacijentima s rascjepima vrlo slična prognozi o uspješnosti ugradnje implantata nakon traumatskoga gubitka zuba. Kvaliteta života pacijenata s rascjepima jednaka je onima bez rascjepa. Matsui i suradnici (50) kažu da je kod ove skupine pacijenata odgovarajuća količina kosti iznimno važna za uspjeh pri postavljanju implantata, tako da se reaugmentacija (tercijarno presađivanje) rascjepa obavlja autogenom kosti s kriste ilijake ili još bolje sa stražnjega dijela *linne oblique* mandibule tri do četiri mjeseca prije (51, 52) postavljanja implantata ili istodobno (53) s njegovom ugradnjom. Implantološkom terapijom postižu se dobri rezultati, ali određena pozornost treba biti usmjerena na volumen kosti kako bi se postigla primarna stabilnost implantata. Složeni protokol liječenja zahtijeva suradnju maksilofacijalnoga i oralnog kirurga te stomatologa-protetičara (slika 10.).

Buduće tehnike

Unatoč činjenici da je autologna kost s kriste ilijake *zlatni standard* u osteoplastici, ipak nije savršen izbor za rekonstrukciju rascjepa alveolarnog grebena. U mnogim člancima ističe se upotreba kosti s čimbenicima rasta dobivenima tkivnim inženjstvom, a možemo se njome koristiti kao alternativnim presađenim materijalom. Jedan od njih je i koštani morfogenetski protein (BMP) na kolagenoj spužvi. Fallucco (54) je dokumentirao određene uspjehe nakon što je upotrijebio taj proizvod, ali njegova visoka cijena i dostupnost ograničavajući su čimbenici. Institucije još nisu dopustile široku upotrebu ove vrste proizvoda.

Glavni razlog za primjenu ovog proizvoda jest izbjegavanje drugoga operacijskog mjesta (55). Zahvaljujući tome izbjegnuti su bolovi u donorskom području, operacija traje kraće, a kraći je i boravak u bolnici pa su smanjeni troškovi liječenja.

stabilization and supports revascularization of the graft. Autogenic bone graft with platelet-rich plasma and bovine bioapatite has great use in implantology (47). In guided bone regeneration, in order to keep away connective tissue from bone gap, bioresorbable collagen barrier membranes (Bio Gide, Geistlich Pharma North America Inc., USA; Ossix, OraPharma Inc., USA) are used (48).

Dental implant (Figure 9) has the role of holding dental prosthesis, prevents pronounced bone atrophy and loads the augmentation material in the cleft area. Edentulous spaces may be small because of surgical and orthodontic pre-treatment accompanied by reduced bone in vertical and sagittal dimension. The soft tissue around cleft defect has a large amount of scar tissue therefore the peri-implant reconstruction is required in some cases.

There are only a few articles in the literature focused on implantological treatment of the cleft. Landes (49) demonstrated in a study that the probability of success of implants in patients with cleft is very similar to prognosis of implants inserted after traumatic tooth loss. The oral-health-related quality of life of cleft patients is similar to that of non-cleft patients.

Matsui et al. (50) emphasized that sufficient bone availability is crucial for successful implant treatment in this group of patients, so re-augmentation (tertiary grafting) of the cleft jaw was undertaken with an autogenous iliac crest graft three or four months (51, 52) before the implants were positioned or simultaneously (53) with implant placement. Implant therapy offers a reliable option for patients but particular attention should be paid to bone volume, which can achieve primary implant stability. The complex treatment procedures require cooperation between maxillofacial surgeon and the implantologist (Figure 10).

Future techniques

Despite the fact that autologous bone from iliac crest is gold standard in osteoplasty, it is not the perfect source for reconstruction of the alveolar cleft. There are many articles focused on bone fabricated by growth factor-aided tissue engineering, usable as an alternative graft material. One of these sources is bone morphogenetic protein (BMP) delivered on a collagen sponge. Fallucco (54) had some success with the application of this product, but this product is expensive and its availability is limited. Institutions have not yet approved the use of this type of product.

The main reason for using these products is the avoidance of the second surgical site needed for the harvesting of autologous bone (55). Thanks to that we have absence of donor site morbidity, shorter operation time, shorter hospital stay and reduction of costs.

Abstract

Cleft lip and palate is the most common congenital deformity affecting craniofacial structures. Orofacial clefts have great impact on the quality of life which includes aesthetics, function, psychological impact, dental development and facial growth. Incomplete fusion of facial prominences during the fourth to tenth week of gestation is the main cause. Cleft gaps are closed with alveolar bone grafts in surgical procedure called osteoplasty. Autogenic bone is taken from the iliac crest as the gold standard. The time of grafting can be divided into two stages: primary and secondary. The alveolar defect is usually reconstructed between 7 and 11 years and is often related to the development of the maxillary canine root. After successful osteoplasty, cleft defect is closed but there is still a lack of tooth. The space closure with orthodontic treatment has 50-75 % success. If the orthodontic treatment is not possible, in order to replace the missing tooth there are three possibilities: adhesive bridgework, tooth transplantation and implants. Dental implant has the role of holding dental prosthesis, prevents pronounced bone atrophy and loads the augmentation material in the cleft area. Despite the fact that autologous bone from iliac crest is the gold standard, it is not a perfect source for reconstruction of the alveolar cleft. Bone morphogenetic protein (BMP) is appropriate as an alternative graft material. The purpose of this review is to explain morphology of cleft defects, historical perspective, surgical techniques and possibilities of implant and prosthodontic rehabilitation.

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Key words

Cleft Lip; Cleft Palate; Alveolar Bone Grafting; Bone Morphogenetic Proteins; Dental implants; Dental prosthesis; Orthodontic Space Closure

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