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PRIKAZ SLUČAJA
CASE REPORT

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Radiološka procjena cijeljenja koštanih defekata punjenih trikalcijevim fosfatom (Bioresorbom) nakon cistektomije u donjoj čeljusti

Radiological Evaluation of the Healing of Bone Defects Filled with Tricalcium Phosphate (Bioresorb) after Cystectomy of the Mandible

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Sažetak
Trikalcijev fosfat -$Ca_3(PO4)_2$ - resorbilna je i biokompatibilna kalcijeva fosfatna keramika vrlo velike čistoće s omjerom atoma kalcija i fosfata vrlo sličnim prirodnom koštanom mineralu, pa se u tkivu ponaša poput vlastita koštanog transplantata. Postupno se resorbira tijekom pregradnje kosti i nadomješta novim koštanim tkivom, a u oralnoj se kirurgiji uglavnom primjenjuje kod većih defekata kostiju nakon operacija cista i tumora te u dentalnoj implantologiji. Svrha je rada opisati dva slučaja cijeljenja koštanih defekata čeljusti nakon operacije čeljusnih cista punjenih granulatom beta-trikalcijeva fosfata (Bioresorb Macro Pore - Oraltronics). Postupak je obavljen na hospitaliziranim pacijentima, uz njihovu suglasnost, u Kliničkom zavodu za oralnu kirurgiju Kliničke bolnice Dubrava. Koštani su defekti punjeni potrebnom količinom granulata veličine zrnaca od 1000 do 2000 µm. Rezultati cijeljenja subjektivno su procijenjeni raščlambom kontrolnih snimaka nakon dva, četiri i šest mjeseci te uspoređeni s cijeljenjem slične koštane šupljine koja je nastala nakon što je uklonjena radikularna koštana cista liječena metodom Partsch II i trajnom poslijeoperacijskom sukcijom. Preliminarni rezultati primjene Bioresorb Macro Porea u liječenju velikih cista donje čeljusti pokazali su vrlo dobru prihvatljivost materijala bez komplikacija - znači bez infekcije ili poteškoća s cijeljenjem rana - a obnova koštane strukture bila je završena u razdoblju od četiri i šest mjeseci nakon zahvata. Opisani slučajevi i njihova usporedba s trećim primjerom govore u prilog primjene resorbilnog trikalcijeva fosfata. Može se pretpostaviti da se na taj način brže uspostavlja očekivana građa kosti negoli kod ostalih poznatih metoda.

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Ključne riječi
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Uvod

Glavna dilema u liječenju velikih čeljusnih cista bila je i ostala - mogu li velike koštane šupljine zacijeliti primarnim zatvaranjem koštanih defekata i organizacijom krvnoga ugruška ili treba uporabiti neke druge standardne postupke, poput marsupijalizacije ili modifikacije kirurških zahvata ili pak puniti defekte koštanim transplantatima, bez obzira na njihovo podrijetlo. O tome i danas postoje različita mišljenja, pa i ono da je primjena različitih koštanih nadomjestaka - aloplastičnih implantata i heterotransplantata – dobila nekritične razmjere i što se tiče njihova izbora, postavljenih indikacija i veličine koštanih defekata u kojima se primjenjuju te se čini da su razlozi za njihovu čestu uporabu više komercijalni negoli medicinski.

Miše (1) je, pišući o postupcima liječenja čeljusnih cista, smatrao da izbor kirurških metoda isključivo ovisi o njihovoj veličini i lokalizaciji.

To je značilo da sve male ciste promjera najviše 2,5 cm treba u cijelosti ukloniti, bez obzira na to gdje su, a koštani defekt ostaviti da cijeli organizacijom krvnoga ugruška. Metoda se pripisivala Carlu Partschu i nazvana je u literaturi metodom Partsch II.

Velike ciste u donjoj čeljusti liječene su drenažom u usnu šupljinu tj. marsupijalizacijom ili Partsch I. metodom (2) , dvofaznom kirurškom metodom, Broschovom metodom (3-5), metodom Partsch II s trajnom poslijeoperacijskom sukcijom (6,7) ili metodama punjenja koštanih defekata autogenim, alogenim ili heterogenim transplantatima ili aloplastičnim ili sintetičkim resorbilnim i neresorbilnim implantatima, a one u gornjoj čeljusti rinološkim metodama (7,8).

Primjena trikalcijeva fosfata ili drugih aloplastičnih biomaterijala za punjenje koštanih defekata čeljusti počinje se u literaturi opisivati prije tridesetak godina (9-11), što je i kod nas rezultiralo s nekoliko istraživanja (12-14). Suvremena znanost i klinička istraživanja u oralnoj kirurgiji bave se tom problematikom i može se reći da je ispitivanje djelotvornosti trikalcijefa fosfata još aktualno u obnovi manjih koštanih defekata u parodontologiji kako bi se postigla brža dinamika cijeljenja velikih koštanih defekata, povećao čeljusni greben, podignulo dno sinusa ili kao potpora dentalnim implantatima (15-18). Mehanizam djelovanja trikalcijeva fosfata objašnjava se obogaćivanjem mikrookoliša razgradnjom materijala i otpuštanjem iona kalcija i fosfora, što potiče aktivnost i proliferaciju stanica. Povećana koncentracija kalcijevih i fosfatnih iona stvara karbonat apatita sličan koštanom apatitu, a izrav-

Introduction

The fundamental dilemma in the treatment of large cysts of the jaws has always been whether large bone cavities can be healed by primary closing of the bone defects and organisation of a blood clot, or whether other standard methods should be used, such as marsupialisation or modification of surgical operations, or even by filling the defect with bone transplants, regardless of their origin. Today, different views still exist on this problem. One such view is that the application of different bone substitutions - alloplastic implants and heterotransplants - have acquired uncritical proportions with regard to their choice, indications and size of the bone defects in which they are applied, and it would seem that the reasons for their frequent use are more of a commercial than medical nature.

In an article on the methods of treating jaw cysts Miše (1) considered that the choice of surgical methods for treatment of jaw cysts depended entirely on their size and location.

This meant that all small cysts, i.e. all those up to 2.5 cm in diameter, should be entirely removed regardless of their location, and the bone defect left to the organisation of a blood clot. The method was attributed to Carl Partsch and is known in the literature as the Partsch II method.

Large mandibular cysts were treated by drainage into the oral cavity, i.e. by marsupialisation or Partsch I method (2), by two-phase surgical method, by Brosch procedure (3-5), by the Partsch II method with permanent postoperative suction (6,7) or by methods of filling the defects with autogenic, allogenic or heterogenic transplants or alloplastic or synthetic resorbable and nonresorbable implants, and maxillary cysts were surgically treated by so-called rhinological methods (7,8).

The application of tricalcium phosphate or other alloplastic biomaterials for filling bone defects of the jaws were first described in the literature thirty years ago, and several studies were also carried out in this country (9-14). Contemporary science and clinical research in oral surgery are concerned with this problem and it can therefore be said that investigation of the effectiveness of tricalcium phosphate is still topical for restoration of small bone defects in periodontology, for faster dynamics of the healing of large bone defects, enlargement of the alveolar ridge, sinus lifting or for support of dental implants (15-18). The mechanism of the effect of tricalcium phosphate is explained by enrichment of the microenvironment by the biodegradable material and release of ions of

no se veže s kosti (16). Na tržištu se mogu nabaviti prirodni i sintetski materijali, a najpoznatija su dva preparata trikalcijeva fosfata u granulama - Bioresorb Macro Pore tvrtke Oraltronics i Curasanov Cerasorb. Oba su vrlo visoke čistoće i za oba postoji opsežna literatura temeljena na rezultatima istraživanja kliničkih slučajeva (19-21). Rezultati cijeljenja koštanih defekata na pokusnim životinjama pokazali su dinamički i anatomski slične rezultate kao i u primjeni autologne kosti (21). Materijal se u razdoblju od osam tjedana gotovo u cijelosti resorbirao, a defekti su potpuno zacijelili s novom kosti.

Postupak

Postupak je proveden na hospitaliziranim bolesnicima Klinike za kirurgiju čeljusti i lica Kliničke bolnice Dubrava koji su se složili s prijedlogom da im se koštane šupljine, nakon što se uklone cistične čahure, ispune granulatom trikalcijeva fosfata (Bioresorb Macro Pore – Oraltronics) veličine zrnaca od 1000 do 2000 μm, s pretpostavkom da će dinamika cijeljenja kosti biti brža nego budu li se primijenili ostali poznati kirurški postupci. Osnovni uvjet za primjenu granulata bila je koštana šupljina s najmanje trima stijenkama, jer bi se u suprotnome moglo očekivati rasipanje granulata u meko tkivo i komplikacije zbog odbacivanja zrnaca. Dinamika cijeljenja praćena je subjektivnom ocjenom i usporedbom radioloških nalaza prije zahvata te dva, četiri i šest mjeseci nakon njega.

Prikaz slučajeva

Radiološka dokumentacija o primjerima cističnih promjena donje čeljusti (jedna odontogena keratocista i jedna traumatska koštana šupljina, obje su nakon kirurškog zahvata metodom Partsch II bile ispunjene granulatom trikalcijeva fosfata - Bioresorb Macro Pore - te klinički i radiološki praćene do potpune obnove kosti) pokazuje da je za cijeljenje koštanog defekta nakon zahvata bilo potrebno četiri do šest mjeseci (Slike 1.a, b, c, d. i 2. a, b, c).

U oba slučaja subjektivna procjena rendgenograma pokazuje postupnu promjenu koštane građe od prosvjetljenja prije zahvata, zrnate sjene strukture materijala nakon zahvata, do uspostave nove trabekularnosti na mjestu defekta nakon četiri i šest mjeseci.

calcium and phosphor which stimulates the activity and proliferation of cells. The increased concentration of calcium and phosphate ions leads to the formation of carbonate apatite which is similar to bone apatite which binds directly to the bone (16). Natural and synthetic materials are available on the market and the best known are two preparations of tricalcium phosphate in granules, Bioresorb Macro Pore, manufactured by Oraltronics, and Cerasorb by Curasan. Both are of very high purity and there is abundant literature on both of them based on the results of studies of clinical cases (19-21). The results of the healing of bone defects in experimental animals showed dynamically and anatomically similar results to the application of autologous bone (21). The material was almost completely resorbed within a period of 8 weeks, and the defects completely healed with new bone.

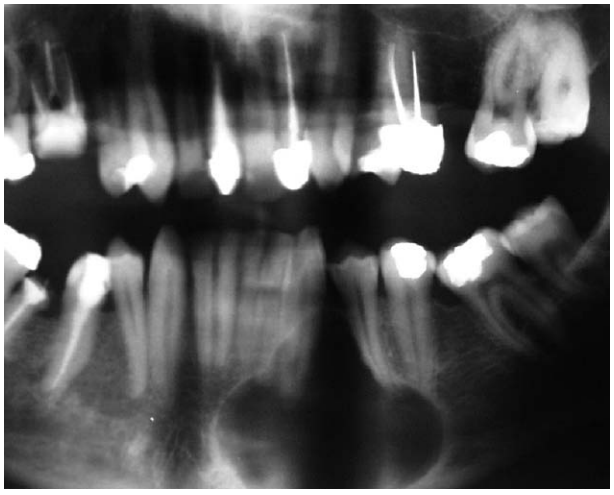
Material and Methods

The method was performed in hospitalised patients at the Department of Oral and Maxillofacial Surgery, University Hospital Dubrava. Patients gave their consent for the bone cavity to be filled with granulate tricalcium phosphate (Bioresorb Macro Pore), granules 1000 - 2000 μ in size, after removal of the cystic capsule, on the supposition that the dynamics of bone healing would be faster than by application of other known surgical methods. The basic precondition for application of the granulate was the existence of a bone cavity with at least three walls, because of the possibility of dissipation of the granules in the soft tissue and complicated rejection of granules. Healing dynamics were followed up by subjective evaluation and comparison of radiographic findings prior to the operation and 2, 4 and 6 months after the operation.

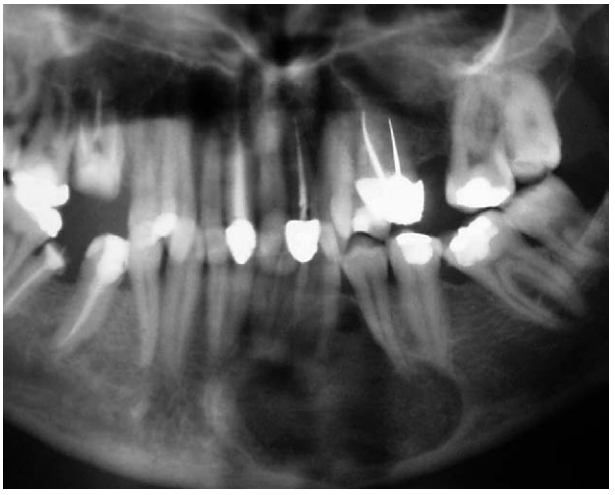
Case reports

Radiographic documentation of examples of cystic lesions of the mandible (an odontogenic keratocyst and a traumatic bone cavity), treated by Partsch II procedure and filled with granulate of Bioresorb Macro Pore and clinically and radiographically followed up until complete bone restoration, showed that a period from 4 to 6 months was necessary after the operation for healing of the bone defect (Figs. 1. a, b, c, d. and 2. a. b. c.).

In both cases subjective evaluation of the radiograph showed gradual change in the bone structure, from translucent prior to the operation, grainy shadow of the material structure after the operation, to restoration of new trabeculation on the site of the defect 4 and 6 months after the operation.

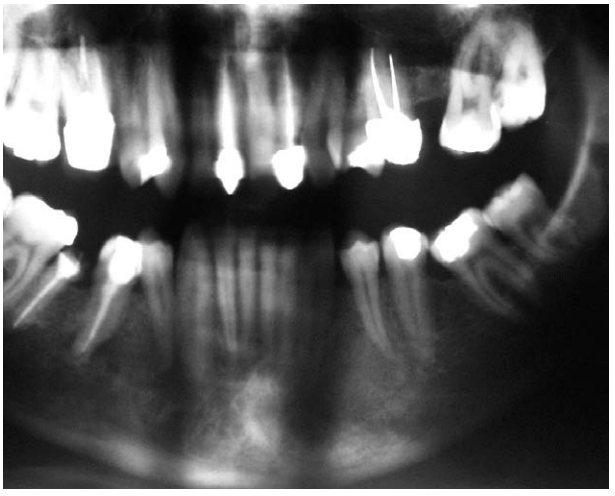


Slika 1. a. Ovalno prosvjetljenje u području simfize donje čeljusti koje razmiče korjenove zuba. Svi zubi su vitalni. Patohistološki je dokazana odontogena keratocista.
Figure 1 a Oval translucency in the frontal part of lower jaw, with dislocation of the roots. The teeth are vital. Histologically proved odontogenic keratocyst.



Slika 1. b. Isti slučaj nakon što je cista izljuštena i šupljina napunjena granulatom trikalcijeva fosfata
Figure 1 b The same case after removal of cyst and application of granulate tricalcium phosphate.

Slika 1. c. Isti slučaj nakon dva mjeseca
Figure 1 c Same case 2 months latter.



Slika 1. d. Rendgenski nalaz šest mjeseci nakon zahvata pokazuje potpunu obnovu kosti
Figure 1 d Complete restitution of bone structure 6 months after the intervention.

Kako izgleda cijeljenje koštanog defekta liječenog drugom metodom, pokazuje treći primjer dviju odontogenih upalnih cista liječenih metodom Partsch II i poslijeoperativnom sukcijom. Snimljeni su prije zahvata te četiri i deset mjeseci nakon zahvata te je jasno da za potpunu obnovu kosti treba još nekoliko mjeseci. Iz prakse svaki kirurg zna mnogobrojne primjere koji nakon primjene te metode liječenja pokazuju sličnu dinamiku cijeljenja kosti, za što je najčešće potrebno dvanaest mjeseci (Slike 3. a, b, c.).

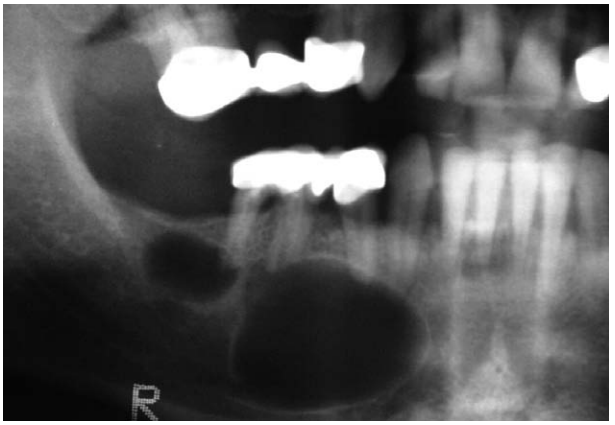
Healing of a bone defect treated by another method is shown in the third example of two odontogenic inflammatory cysts, treated by the Partsch II method and postoperative suction, X-rayed prior to the operation and 4 and 10 months after the operation, which clearly shows that several more months are needed for complete bone restoration. There are numerous examples which demonstrate that the application of similar methods of treatment show similar dynamics of bone healing, for which most frequently 12 or more months are required (Figs. 3 a, b, c.).

Slika 2. a. Koštano prosvjetljenje obuhvaća korjenove donjeg pretkutnjaka i prvog kutnjaka. Zubi su vitalni. Tijekom zahvata potvrđena je traumatska koštana šupljina.
Figure 2 a Bone translucency around roots of second lower premolar and first molar. The teeth were vital. Traumatic bone cavity was confirmed during the intervention.

Slika 2. c. Isti slučaj nakon četiri mjeseca pokazuje potpunu obnovu kosti
Figure 2 c The same case 4 months later presents complete restitution of bone.

Slika 3. b. Radiološki nalaz nakon četiri mjesca pokazuje prosvjetljenje nešto blažeg intenziteta
Figure 3 b Radiological finding after 4 months presents transluceny of lower intensity.

Slika 2. b. Isti slučaj odmah nakon kiruškog zahvata i punjenja šupljine granulatom.
Figure 2 b The same case imediately after intervention and filling the cavity with granulate.



Slika 3. a. Koštano multilokularno prosvjetljenje oko korjenova donjeg pretkutnjaka i kutnjaka odgovara radikularnim upalnim cistama. Obavljena je cistektomija Partsch II s poslijeoperativnom sukcijom.
Figure 3 a Bone multilocular translucency around roots of second lower premolar and first molar caused by two radicular inflammatory cysts. Partsch II operation with permanent postoperative suction was performed.

Slika 3. c. Isti slučaj nakon deset mjeseci. Još je vidljivo prosvjetljenje, ali je slabijeg intenziteta.
Figure 3 c The same case after 10 months. Transluceny is still visible.

Rasprava

Preliminarni podaci o kirurškome liječenju velikih koštanih šupljina čeljusti pokazali su na jednom od prije istraženih kliničkih uzoraka da su se neke metode, koje su nekada smatrane isključivima u donjoj čeljusti, posljednjih desetljeća manje primjenjivale (7,8). To ponajprije vrijedi za metodu poznatu pod nazivom Partsch I, koja se obavlja u iznimnim slučajevima kad su izrazito velike patološke promjene u čeljusti ili kod bolesnika kod kojih je zahvat u općoj anesteziji rizičan zbog njihova zdravstvenog stanja. Tako je u tome uzorku nađen tek jedan takav primjer u liječenju odontogene keratociste koja je zauzimala cijeli uzlazni krak i tijelo donje čeljusti, pa je bilo nemoguće ukloniti patološku promjenu bez resekcije čeljusti ili bez rizika za patološki prijelom tijekom zahvata (8).

No, danas se u literaturi mogu naći podaci koji pokazuju da se primjenom marsupijalizacije i ispiranjem šupljine "odontogenih keratocista" mijenja potentnost njihova epitela i smanjuje sklonost recidiviranju (22-26). O mogućnosti pojave karcinoma u epitelu cistične ovojnice postoje dokumentirani podaci u domaćoj (27-29) i stranoj literaturi (30-35), što je osnovni razlog zbog kojega cističnu čahuru treba tijekom zahvata potpuno izljuštiti, pa su metode marsupijalizacije u sklopu razmišljanja o mogućnostima diskutabilne. U kontekstu mogućnosti alteracije cističnog epitela u maligni epitelni tumor treba spomenuti i mogućnosti nastanka primarnih planocelularnih karcinoma. Oni mogu nastati iz oralne sluznice, sluznice sinusa, ostataka odontogenog epitela, ameloblastoma i keratinizirajućeg cističnog odontogenog tumora (prijašnji naziv odontogena keratocista). Razvoj karcinoma iz keratinizirajućeg cističnog odontogenog tumora je rijetkost (do 1992. godine u literaturi je opisano samo 6 slučajeva (22)), ali i tu mogućnost ne treba zaboraviti pri planiranju liječenja odontogenih cista.

Metoda Partsch II svaki se dan koristi bez obzira na veličinu koštanih defekata, ali se redovito kombinira s primjenom trajne poslijeoperacijske sukcije, dekortikacijom jedne čeljusne stijenke ili tzv. Broschovom tehnikom ili pak s punjenjem koštanog defekta granulatom odgovarajućega osteokonduktivnog materijala (2,7,8). U prikazanim primjerima primijenjen je resorbilni materijal trikalcijeva fosfata s tvorničkim imenom Bioresorb Macro Pore te se preliminarni rezultati mogu smatrati zadovoljavajućima.

Discussion

Preliminary data on surgical treatment of large bone cavities demonstrated in one of the previously investigated clinical samples that some methods, which in the past were in fact considered exclusive, have in the last ten years been used less in the mandible (7,8). This is primarily the case for the method known as Partsch I, which is applied in exceptional cases of extremely large pathological jaw lesions or in patients in whom an operation under general anaesthetic is risky because of their state of health. Thus only one such example in the treatment of odontogenic keratocyst was found (in that sample) which involved the whole of the ramus and body of the mandible and it was therefore impossible to remove the pathological lesion without resection of the jaw or risk of pathological fracture during the operation (8).

However, today data can be found in literature which show that with the application of marsupialisation and rinsing the cavities of odontogenic keratocysts change the potency of their epithelia and decrease the tendency to recurrence (22-26). There are documented data in domestic and foreign literature (27-35), on the possibility of the occurrence of carcinoma in the epithelia of the cystic capsule, which is the main reason for complete removal of the cystic wall, and this fact makes the use of marsupialisation as the method of choice problematic. With regard to the alteration of cystic epithelia into a malignant epithelial tumour, we should also mention the possibility of the occurrence of primary squamous cell carcinoma from oral mucosa, mucous membrane of the sinus cavity, remnants of odontogenic epithelia, ameloblastoma, and keratinizing cystic odontogenic tumour (previously called odontogenic keratocyst). Development of carcinoma from keratinizing cystic odontogenic tumour is rare (up until 1992 only 6 cases were described in the literature) although this possibility during the treatment of an "odontogenic keratocyst" should not be overlooked (22).

Partsch II method is used daily regardless of the extent of the bone defect, although it is regularly combined with the application of permanent postoperative suction, decortication of one jaw wall or the so-called Brosch procedure, or even filling of the bone defect with granulate of an appropriate osteoconductive material (2,7,8). In the examples presented a resorbable material, tricalcium phosphate Bioresorb Macro Pore, was used. The preliminary results can be considered satisfactory.

Zaključak

Mogućnosti kirurškog liječenja velikih koštanih šupljina čeljusti mnogobrojne su i ne treba ih isključivo razdvajati, jer su moguće njihove kombinacije i modifikacije.

Iz citirane literature jasno je da povijesne podjele na velike i male ciste danas nisu toliko važne, jer je sve velike ciste moguće liječiti modifikacijama metode Partsch II.

Temeljno načelo u izboru kirurške metode liječenja treba podrediti naravi patološke promjene i u skladu s time obaviti zahvat.

Primjena aloplastičnog resorbilnog materijala, u konkretnome slučaju granulata trikalcijeva fosfata Bioresorb Macro Pore, omogućuje bržu dinamiku cijeljenja kosti u usporedbi s cijeljenjem koštanog defekta organizacijom krvnoga ugruška.

Conclusion

The possibilities of surgical treatment of large bone cavities of the jaws are numerous and do not need to be strictly separated, because of the possibility of their combination and modification.

From the mentioned literature it is clear that historical classification into large and small cysts is no longer as important today, as all large cysts can be treated by modifications of the Partsch II method.

The fundamental principle when choosing the surgical method of treatment should depend on the nature of the pathological lesion and the operation should be performed accordingly.

The application of alloplastic resorbable materials, in this case granulate tricalcium phosphate Bioresorb Micro Pore, enables faster healing dynamics compared with healing by organization of a blood clot.

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Abstract

Tricalcium phosphate -$Ca_3(PO4)_2$- is a resorbable and biocompatible calcium phosphate ceramic with the ratio of calcium and phosphate atoms very similar to natural bone mineral and consequently in the tissue it behaves like an autogenic bone transplant. It is gradually resorbed during remodelling of the bone and substituted with new osseous tissue. In oral surgery it is mainly used for large bone defects which develop during operations for cysts and tumours and in dental implantology. The purpose of the study was to present two cases of the healing of bone defects after operation of jaw cysts filled with granulate beta-tricalcium phosphate (Bioresorb Macro Pore - Oraltronics). The method was performed on hospitalised patients with their prior consent in the Department of Oral Surgery, University Hospital "Dubrava". Bone defects were filled with the required amount of granulate, granules 1000 - 2000 µm in size. The results of healing were subjectively evaluated by analysis of radiographs after 2, 4 and 6 months and compared with the healing of a similar cavity after enucleation of a bone cyst treated by Partsch II method with permanent postoperative suctions. The preliminary results of the application of Bioresorb Macro Pore in the treatment of large mandibular cysts showed very good acceptability of the material, with no complications with regard to infection or problematic healing of the wound, and restoration of the bone structure was completed within a period of 4 and 6 months after the operation. The examples presented and their comparison with a third example support the application of resorbable tricalcium phosphate. By this method the anticipated bone structure is achieved faster than by other known methods.

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Key words
Tricalcium Phosphate; Bioresorb Macro Pore; Jaw Cysts; Surgery; Oral

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