Intraosseous dental implants fixed on mandibular autogenous bone transplants

Anton Iordanov Djorov

Sofia, Bulgaria

Summary

We present our experience of one-time and secondary free bone plastic surgery of the mandible with autogenous iliac transplants. We formed them with three-dimensional computed tomography skull views to increase the cell osteoblastic activity and processes of regeneration and remodeling. On the autogenous bone transplants we placed intraosseous dental implants - Bulgarian "SIP" system. We followed the results from 3 to 5 years. They showed low level of resorption of the transplants and normal dental rehabilitation of the patients. It increases their functional, aesthetic and psychosocial recovery.

Keywords: mandibular defects, three-dimentional skull views, autogenous iliac transplants, dental implants - "SIP" system.

Introduction

Mandibular defects may result after large surgical interventions in treatment of blastoma processes or after trauma with high kinetic energy. They are followed by severe functional and aesthetic problems, which need reconstructive surgery [1]. A great number of authors define as basic methods the one-step or secondary free bone grafts [2-6]. When the spongious bone is used for reconstruction of mandibular defects it initiates microvascular anastomosis between the vessels of the transplant and the recipient site by the type “end to end”. The iliac grafts, used for reconstruction of the lower jaw survive in a way, usual in case of the fractures treated by immobilization. That supports the theory that they have enough living cells with a possibility to produce bone tissue. The anatomically shaped transplant and its early mobilization are important factors for the osteoblastic activity of cells. This process enhances a correct muscle tension and better bone repairing [7]. When there is a normal functional activity, requiring adequate dental rehabilitation, the resorption decreases [8].

The first note for prosthetic implant reconstruction on defects of the lower jaw, recovered by free bone grafts, is dated from the beginning of the 90s and the results were satisfactory [9]. The choice of different types of implants is according to the thickness of the bone and the type of prosthetic rehabilitation. The choice of the bone grafts depends on the size of the defect, quality of the bone, the experience of the surgeon and the operative risks in the donor site [8,9,10]. Frodel, Funkg, Capper, Fridrich, Blumer, Haller, Hoffman [11] make a conclusion that the most favorable for practice are the grafts from the iliac crest and the fibula.

Good preoperative planning has a great significance for the success of the mandibular reconstructive surgery and dental implantology. New methods of visualization were developed based on overlapping scan.

Nowadays we have the needed database for creating tri-dimensional (TD) images [12,13,14]. The Shaded Surface Display (SSD) method creates TD images, which show the superficial structure of the skin, bones and teeth. The Multiplanar Reformatting (MPR) method with the help of many cross-axial cuts of jaws, their alveolar crests and dental arches helps the preoperative planning in dental implantology. The personal computers make their use by clinicians possible. That enlarges the opportunity for direct measurements and more exact realization of the operative plan [14,15].

Purpose

Our purpose is to follow the results after mandibular reconstruction with anatomically shaped autogenous bone transplants from the iliac crest through tri-dimensional computed tomography skull images. We fixed on them Bulgarian titanic intraosseous screw dental implants – "SIP" system.

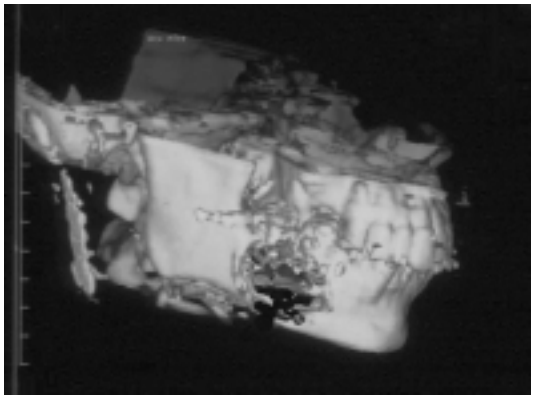
Patients and Methods

Three male patients, aged from 32 to 49 years were treated by autogenous mandibular reconstruction with free bone grafts from the iliac crest. In two of these cases the defects are results from tumor ablation, histologically proved as chondrosarcoma *(Figure 1)* and recurrent ameloblastoma *(Figure 2).* The lines of the resections were made in the body, angle and the ascending ramus of the lower jaw. In the case of the patient with ameloblastoma we also made an exarticulation. In the third clinical case the defect in the mandibular body was a result after a shot injury *(Figure 3).* A one-step reconstruction was conceived in the case of ameloblastoma and a secondary – in the other two cases.

Figure 1.

Figure 2.

Figure 3.



We used our own method to evaluate the anatomical shape of the transplants from the iliac crest and the size of the mandibular defects with the help of three-dimensional computed tomography skull images [16]. By SSD technique we received views in full right and left profile. We corrected the size

and received on the computer screen the real mandibular size. *(Figure 4).* We put the scanned views of the healthy and affected halves of the lower jaw one on the other. We evaluated the size of the defect and the form of the transplant. We made a model, which was used in the operating room and took the necessary segment of the iliac bone of the patient, experiencing much more accuracy *(Figure 5).*

We made an immobilization of the preserved part of the mandible in central occlusion. We fixed cortico-spongious transplants with functionally stabilizing osteosynthesis. The masticatory muscles were sutured again in their anatomical position. The intermaxil-

Figure 4.

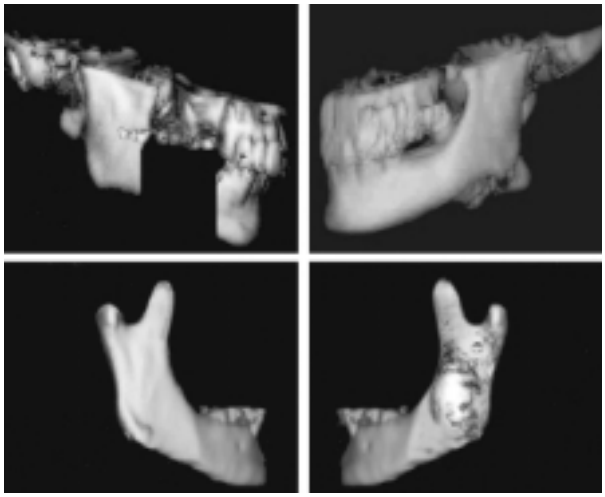
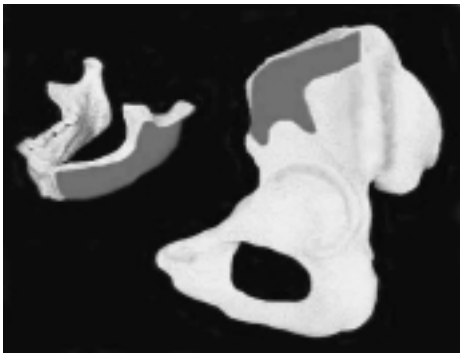


Figure 5.



lary immobilization lasted 4 weeks.

The dental implants were fixed on the transplants 18 months after the mandibular reconstruction. By the MPR method we made their preoperative planning. We used 10 titanic intraosseous screwed two-step Bulgarian implants – "SIP" system. The diameter of four of the implants was 3,6 mm, 12 mm in length; six of them had 4,3 mm in diameter and 12 mm in length. The patients were prosthetically recovered 4 months later with bridges. We followed the results clinically and with X-ray from 3 to 5 years. The implants were estimated by the criteria of Albrektsson, Zarb, Worthington, Eriksson [17]. The percentage of marginal bone failure and active bone-implant surface were defined with segmental retroalveolar X-ray control using the method of Van Steenberghe [18], modified for the "SIP" system by Iordanov [19]. To show the level of resorption and atrophy of the alveolar part of the grafts we used a combined scale and the method of Kulikov [20], modified by Popov [21] and Anastassov [22].

Results

In the early post-operative period the X-ray observation showed in all patients a good bone contact and fixation. After taking off the immobilization we had a normal healing process, clinically and radiologically. On the 6th month the soft tissue followed the contour of the bone grafts in high percentage *(Figure 6).*

After the 1st year we saw on radiographs resorption in this part of the transplants that substituted the ascending ramus of the jaw (Figure 7).

There were no changes in the contour of the soft tissue and the balance in the lower third of the face was good (*Figure 8*).

Figure 6.

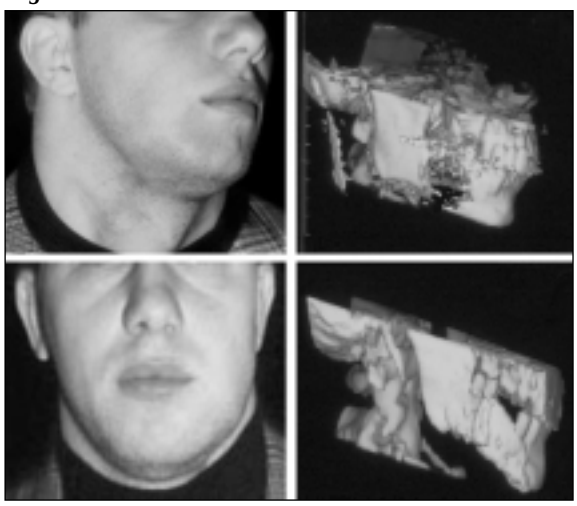


Figure 7.

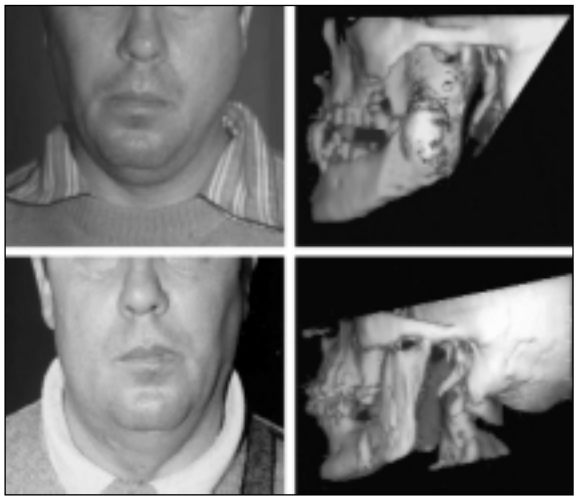
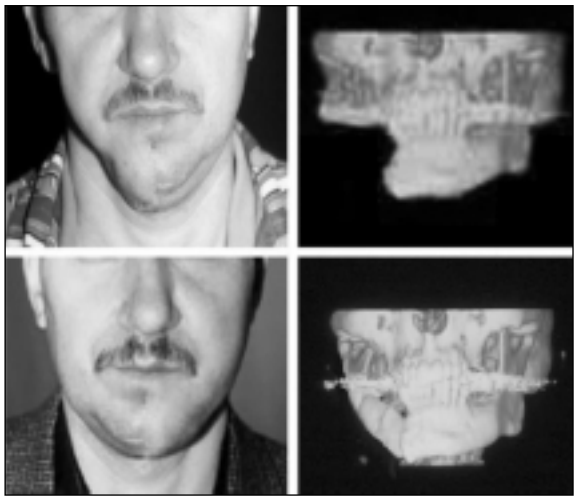


Figure 8.



After the insertion of the dental implants the structure of the transplants was satisfactory. Histologically we proved a normal bone with bone marrow. The implants had good osteointegration (*Figure 9*).

After the 1st year, the marginal bone loss (evaluated by the method of Van Steenberghe) was in average 11% and the active implant surface – 89 %. On the 3rd year the marginal bone loss was 15% and in the case followed five years there were no changes. The percentage of resorption and atrophy of the alveolar part of the transplants surrounding the implants (estimated by the method of Kulikov, Popov, Anastassov) was 11% after the 1st year, 14% after the 3rd and the 5th year.

Discussion

The classical techniques for free autogenous bone transplantation are still in use. Corticospongious transplants from the iliac crest satisfy the needs of the recovering surgery of the lower jaw. The obtained results show that the part of the spongious bone is substituted by cicatricial fibrosis in the ascending ramus, but that did not affect the final results. The principle of Wolff "the form and the structure of the bone depend on the pressure of the muscles" must be respected. The exactly formed transplants from the iliac crest by the help of three-dimensional computed tomography cranial images, put in a proper position and early functionally integrated with a rigid fixation, show optimal regeneration and remodeling. The soft tissues in high percentage follow the contour of the iliac grafts. The improved aesthetic results increase the social adaptation of the patients. The pain in the donor site and the more difficult movement of the leg is a disadvantage of the method but a good surgical technique makes these complaints decline in a month.

Figure 9.

The success of the use of dental implants fixed on autogenous bone transplants from the iliac crest proves their vitality and decreases their resorption. The satisfactory dental rehabilitation of the patients and the good osteointegration proved that the Bulgarian titanic implants – the "SIP" system may be used very successfully in cases with reconstructed mandibular defects.

References

1. Henderson D: *Colour atlas and textbook of orthognathic surgery*. Wolfe Medical Publications Ltd, 1985, 9-23, 131-132.
2. Georgieva K, Kostov P, Bochev V and Topalova S: Current aspects of plastic surgery in the maxillo-facial region. *The novelty in dentistry* 1980; ²V, 75: 83. (in Bulgarian)
3. Ugrinov R and Kostov P: Comparative research on use of bone transplants in plastic-repairing surgery of mandibular defects. *Problems in dentistry* 2003; **XXIX**: 89-92. (in Bulgarian)
4. Peri G, Blanc J, Mondie J et al.: La reconstruction des pertes des substance interruprices de la mandibule. *Revue de Stomat et de Chir Max Fac* 1989; N3, 90: 143-211.
5. Reychler H and Piette E: La reconstruction osseuse mandibulaire, revue des possibilities actuelles. *Acta Stom Belg* 1985; N1, 82: 47-64.
6. Salyer KE, Newsom HT, Holmes RE and Hanh G: Mandibular reconstruction. *Amer J Surg* 1977, **134**: 461.
7. Salyer KE: Bone transplantation. In recent advance in plastic surgery edited by Jackson IT, 1981, **X**: 267-285.
8. Schliephake H, Schmelzeisen R and Wondera L: Comparison of the late results of mandibular reconstruction using nonvascularized or vascularized grafts and dental implants. *J Oral Maxillofac Surg* 1999; 57: 944-950.
9. Goga D, Giumelli B, Fassio E, Picard A, Romieux G and Bonin B: Reconstruction mandibulaire microvascularisee et implantoloqie. *Rev. Stomatol. Chir. Maxillofac* 1998; **99**, 5/6, 231-234.
10. Fleuridas G, Favre E, Paranque A, Chikhani L, Lockhart R, Dubruille J, Bertrand J and Guilbert F: Les greffons parietaux en chirurgie maxillo-faciale et pre-implantaire. *Rev Stomatol Chir Maxillofàc* 1998; **99**, 3: 165-169.
11. Frodel JL, Funkg F, Capper DT, Fridrich KL, Blumer JR, Haller JR, Hoffman HT: Osteointegrated implants: a comparative study of bone thickness in four vascularized bone flaps. *Plast Reconstr Surg* 1993; **92**: 449-455.
12. Kawamata A, Ariji Y and Langlais R: Three dimensional computed tomography imaging in dentistry. *Dental Clin of North America* 2000; **44**, 2: 395-408.
13. Parks ET: Computed tomography applications for dentistry. In Dental clinics of North America., 2000; Appl. Dig. Imag. Modal. Dent; **44**, 2: 371-394.
14. Vannier M and Marsh J: Three-dimensional imaging surgical planning and image guided therapy. *Radial Clin North America* 1996; **34**: 545-563.
15. Djorov A and Rochev D: The use of three-dimensional (3 D) computer-tomographic views and models in dental, maxillo-facial, orthognatic and cranio-facial surgery. *Quintessenz* 2003; **2**: 75-79. (in Bulgarian)
16. Djorov A and Nikolov I: A method for measurement of the size and anatomical shape of autogenously bone transplants using three-dimensional computer-tomographic views of the skull. *Radiology* 2004; **XLIII**, 4: 298-300. (in Bulgarian)
17. Albrektsson T, Zarb G, Worthington P, Eriksson A : The long-term efficacy of currently used dental implants. A review and proposed criteria of success. *Int J Oral Maxillofac Implants* 1986; 11: 11-25.
18. Van Steenberghe D: A retrospective multicenter evaluation of the survival rafe of osseointegrated fix-

tures supporting fixed partial prostheses in the treatment of partial edentulism. J Prosthet Dent 1989, 61, 217-223.

19. Iordanov B: Implants – prosthesis repairing by bridges. Dissertation work. BAN – Sofia, 2004; pp 85-89. (in Bulgarian)

20. Kulikov I: Functional researches on the normal and pathological mobility of the teeth. Dissertation work. BAN – Sofia, 1976; pp 52-74. (in Bulgarian)

21. Popov N: Dental implantology (to Dentistry of the XXth century). Index 1999, pp 298-303. (in Bulgarian)

22. Anastassov I: A method for measurement of the atrophy of the mandibular alveolar bone. *Dentistry* 1989; 6: 47-50. (in Bulgarian)

Correspondence to: Dr. Anton Iordanov Djorov, Assist. Prof., Department of Dental and Maxillofacial Surgery, Faculty of Stomatology, University of Medicine – Sofia. Maxillo-facial surgeon in "AMA – medical and dental center" – James Baucher blv., bl.122, Sofia, Bulgaria. E-mail: amadent@abv.bg