CASE REPORT

Bone reconstruction in severe defects of the mandibular residual ridge in oral surgery.

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Abstract
Dental implants placement is often limited by the anatomy of the alveolar bone. Patients often lose their teeth due to alveolar bone resorption, tooth extraction, trauma thus making it difficult to place implants in an optimal prosthetic position. The loss of width of the residual alveolar ridge that is needed to place implants often needs a remodeling of the lost dimensions.
This case reports the successful management of such a patient where the placement of implants possible by autogenous bone block graft techniques obtained from the external oblique line of the mandible with predictable osseointegration and implant stability.
Keywords: dental implant complication, implant fracture, occlusal load, management.

Introduction

The placement of dental implants is frequently restricted because of the quality and quantity of the available alveolar bone. [1-3]

The adequate bone volume necessary for the insertion of dental implants is many time decreased after the loss of the teeth, after facial trauma, affections of the periodontal tissues, and other dental pathologies. [1,4,5]

Autogenous bone grafting techniques have been documented to have a high effect in the reconstruction of jaw anatomy, esthetics restaurtions and biomechanical support for dental implants placement. [6,7]

The bone block autografts utilisation is indicated when is desired an increased volume of the bone ridge, especially for the development of an implant site. [1,8]

The advantages of the autograft bone blocks is that they maintain bone structures like minerals, collagen, viable osteoblasts and bone morphogenic proteins with the disadvantage of the morbidity of the second surgical site. [5,9-11]

The case presented in this article clinically demonstrates the efficacy of using a block graft for dental implant placement in the lateral mandibular region.

Case report

A 36-old male patient, P.C., without medical history, has presented in our clinic for initial consult. The initial clinical examination revealed partial edentoulism in the fourth quadrant, more precisely missing teeth in the position of 4.5. and 4.6., as well as the presence of decays on several teeth. According to the anamnesis the patient experienced extractions of the two missing teeth 2 months earlier in an another dental office.

The radiological examination, by CBCT scan (figure 1), revealed the presence of a residual granuloma next to the apex of the extracted tooth 4.5. In addition, the alveolus of the extracted tooth 45 was partially mineralized and its buccal cortical plate was missing. In position of tooth 4.6. the edentoulus ridge is almost sufficient for implant insertion.

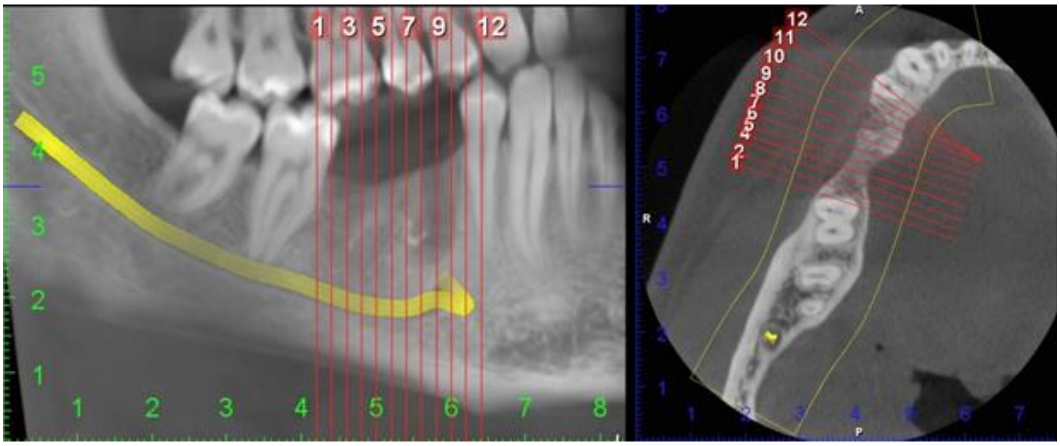

Figure 1. Preoperatory CBCT

Because of the insufficient bone width of the surgical site, the treatment plan includes a bone augmentation technique with intraoral harvested bone graft from the external oblique line. The surgery includes simultaneous implant placement, a 3,75 mm diameter and 13 mm length implant in the position of the 4.5. missed tooth, and a 4,2 mm dimater implant with a 11,5 mm length in position of 4.6. missed tooth.

The implant osteotomy for 45 was performed with high precautions in preserving the integrity of the inferior alveolar neurovascular bundle. The bone gap consisting of the missing buccal cortical bone plate will result in creating a neoalveolus, which will have only three bone walls to surround the implant surface. This clinical situation is in favour for a simultaneous bone block with implant insertion technique, because the neoangiogenesis process, which will provide the surgical site with mesenchymal stem cells, will take place inside of the bone contour. Subsequently the healing process will be similar to that of an postextractional socket.

Local anesthesia by infiltration, respectively, peripheral troncular anesthesia for the inferior alveolar nerve was performed. The anesthesia technique did not include the buccal nerve, which was additionally anesthetized. The used substance is articaine hydrochloride with the highest adrenaline concentration (1: 100,000), named Ubistesin Forte®.

Before the surgical procedure a small quantity of blood was drawn form the patients peripheral vein. 9ml of blood were trasferred into 6 blood collection tubes with clot activator (Vacutest Kima® srl, Arzergrande, Italy), with the purpose of creating PRF membranes (figure 2).

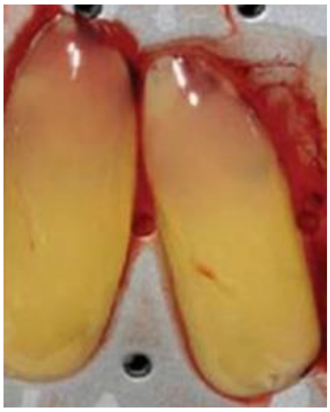

Figure 2. PRF membranes

The preoperative medication consists of amoxicilyn and clavulanic acid 2 g and dexamethasone 8 mg i.v. to reduce the postoperative edema.

Incisions were performed on the middle of the edentoulus ridge, as well as two releasing incisions next two the canine and the third molar and an intrasulcular incision around teeth 4.4., 4.7. and 4.8. (figure 3). All of them were performed with the aid of a 15C scalpel blade. As a result a mucoperiosteal flap, with a trapeziodal contour, was elevated from the mesial vertical releasing incision, with the aid of a surgical tweezer and a periosteal. During the mucoperiosteal flap elevation the mental nerve is highlighted and isolated to avoid its injury during implant osteotomy.

When bone augmentation techniques are intended, both with bone block or just bovine bone grains, the surgeon must consider to create large, extended flaps to gain a certain elasticity, in order to avoid tension or pressure on the augmented site. Unfavorable tension could lead to complications by dehiscnece, followed bone graft exposure and possible infection.

The trapeziodal mucoperiosteal flap which was chosen in this clinical case, is the most common type of flap used in oral surgery. It provides excellent access, produces no tension and allows an easy reapproximation to its original position, hastening in this way the healing process.

Figure 3. Mucoperioseal elevation and aspect of the bone defect

The bone block is harvested with the aid of the piezosurgery unit (Mectron® S.p.A, Carasco, Italy), using the micro-saw shaped OT7S insert. Four osteotomy grooves are performed in the external oblique line of the mandible to define the contour of the bone block in a rectangular form. To choose the exact dimension of the bone segment to be harvested, a sterile paperboard form the suture pack was used as a frame and helped the surgeon in designing the contour of the bone block. Constat irrigation with saline solution is necessary to avoid excessive frictional heat and subsequent necrosis. The highest temperature, considered safe enough when creating the osteotomy lines is 47°C.

The block was then removed by a straight, thin chiesel with necessity of hammering. The bone block is split into two thinner blocks with a diamond disk, and finished with a diamond round bur and straight handpiece. The finishing process is necessary to avoid sharp margins, which can lead to surgical wound dehiscence. With the aid of a special designed drill (ACM –drill), small autogenous bone chips are harvested.

Next, the implant osteotomy preparations are created step by step with the drills from the ARDS® implant kit.

After marking the correct position of the future implants on the bone ridge, the pilot drill is inserted only up to 5,5 mm to verify and correct, if necessary, the implant direction. Using a parallel guide pin preparation it can be easily checked if the position is parallel to the adjacent tooth 4.4. (figure 4).

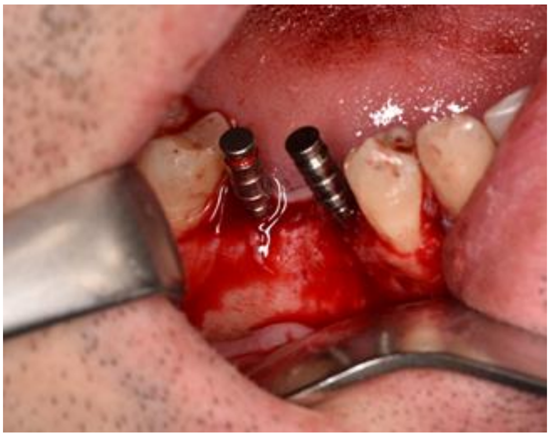

Figure 4. Parallelisms of pin placement

The guide pin also serves to check the future implant position to the occlusal plane. The angle and direction of the drill is corrected according to the parallel guide pin and then the osteotomy drill is inserted up to the final length of the desired implant. In addition, for both implants, the preparations will be 1mm deeper (13 mm plus 1 mm for 4.5. and 11,5 mm plus 1mm for 4.6.). The significance of this type of osteotomy is the 0,5 mm subcrestal implant placement and on the implant apex must not apply pressure on the bottom of the preparations.

Using successive thicker drills from the implant kit, the size of the osteotomy will gradually increase. For an implant diameter of 3,75 mm the last drill has a 3,65 diamater and for the 4,2 mm implant diameter, the last drill has a 4,0 mm diameter.

To improve angiogenesis and to stimulate the migration of mesenchymal stem cells in the recipient bed, several holes are drilled into the buccal cortical bone plate (figure 5). In this purpose a straight handpiece is used and a special spear drill is inserted up to 2-3 mm in the trabcular bone. Bleeding of the recipient surgical bed is a good sign of future agiogenesis process for the integration of the bone graft.


Figure 5. Preparation of implant neoalveolae and selective trepanation of buccal cortical bone


Figure 6. Implant insertion

Implant insertion is performed with the dynamometric ratchet with the highest insertion torque of 50 Nm. A higher force for implant placement may conduct to a unfavorable higher pressure on the bony walls of the preparation, which leads to bone resorbtion and consequent implant failure. To prevent microbial colonization because of the restant blood inside the implant, this one will be cleaned with saline solution and antiobiotic gel will be applied before cover screw insertion.

The implant placement is followed by the rigid fixation of the bone block by the aid of osteosynthesis screws, from Devemed®, and a special designed screwdriver from STOMA company. The two bone blocks are fixed one after the other, next to implant 4.5. and distally for 4.6., each of them with one osteosynthesis screw (figure 7).

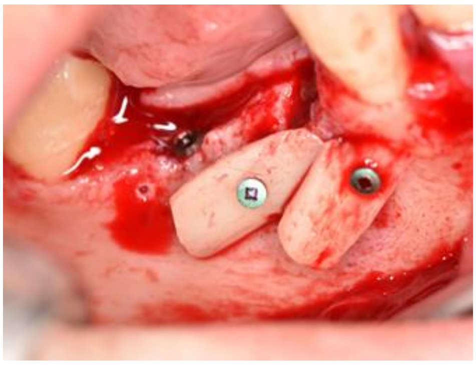
Figure 7. Placement of cortical bone blocks with osteosinthesis screws

After the rigid fixation of the bone blocks, bone chips were applied as an inside lining of the bony framework. The bone chips were plugged between the implant body and the bone block, and between the cortical bone plate of the mandible and the other bone block (figures 8,9).

Excessive plugging must be avoided, because the space between the thiny bone fragments allows neoformation of blood vessels, in the entire structure of the graft, in order to contribute to integration and neoformation of bone tissue. The PRF membranes (figure 10) are used to create an ouside lining for the bone graft, without additional need to apply low resorption rate membranes (up to 4-6 months), like pericardium membranes.

The mucoperiosteous flap suture was performed according to horizontal mattress suture technique, with polypropylene, monofilament sutures (figure 11). A 6.0 thickness thread and needle with triangular shape in cross section with 10 mm and 12 mm length were chosen. The sutures were removed 10 days after the surgery, when a small dehiscence next to implant 4.5. was observed. The cover screw was removed and a healing abutment was inserted instead to avoid debris to enter underneath the flap.


Figure 8. Patient harvested bone

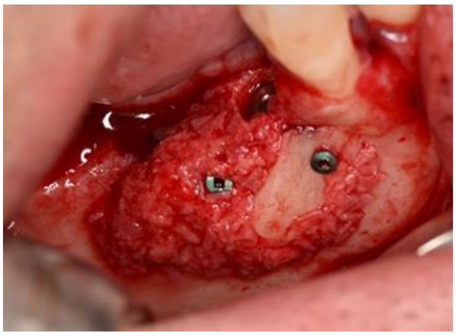
Figure 9. Covering of the cortical bone blocks with autologous bone particles


Figure 10. Placement of PRF membranes


Figure 11. Suture

Immediatelly after the surgery a panoramic x-ray was performed. The first postoperative check was performed 48h after the intervention, and then every 25 days (figure 12).

Figure 12. Postoperatory Rx

After 3, 12 and 24 months postoperative CBCT were performed to analyse and verify the bone graft created in the surgical site, as well as its volume preservation in time.

Three months after the procedure the patient was recalled (figure 13) for implants uncovering. Intraoperative examination proved the integration of the bone blocks, and of the autologous bone chips.

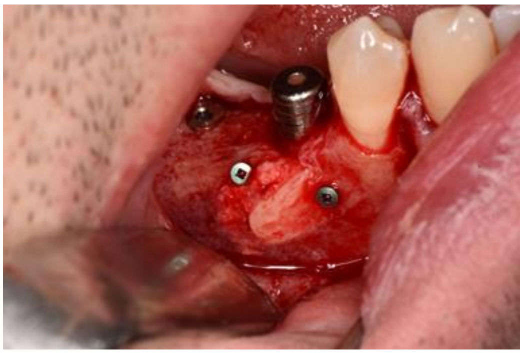
Figure 13. Bone graft aspect at three months post op

The new formed bone is not completely mineralized yet. New formed blood vessels can be observed on the surface of the integrated bone graft. The cover screw from implant 4.6. is removed, the implant screw channel is cleaned with saline solution and the healing abutment is inserted for implant 4.6. as well. Suture is peformed with polypropylene 6.0 thread and 12 mm long needle. At this point the implant stability is measured with the Osstell® (Osstell AB Goteborg, Sweden), showing 82 ISQ for implant 4.5. and 85 ISQ for implant 4.6. (figures 14, 15).

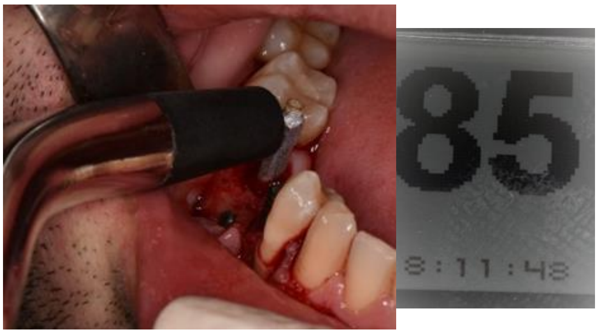

Figure 14. Measuring the stability of 4.6 with OSSTELL®

Figure 15. Measuring the stability of 4.5 with OSSTELL®

Osstell® values under 60 ISQ are correlating with a poor implant stability, those between 60-70 ISQ are meant for a medium implant stability and higher than 70 ISQ values indicate a good implant stability. The measured values in this clinical case (80 and 82 ISQ) are excellent results considering the implants stability in grafted bone site with bone blocks and autologous bone chips.

Three weeks after complete epithelialization of gingiva around the healing abutments, the impression is taken in order to create the prosthetic restorations on the implants. The prosthetic treatment plan included individual, screw-retained metal-ceramic crown (figures 16-19). The first treatment stage included an alginate impression to make the individualized tray. In this case it was created in the dental laboratory, from composite material. The impression abutments were screwed in the implants and with polyether, an open tray impression was used.

After the setting of the impression material, the excess was removed by the aid of a scalpel in order to allow rigid fixation of the impression abutments to the composite tray. For the upper teeth an alginate impression was taken and the bite registration was performed by the aid of a silicone impression material. When inserting the final restoration, the Sheffield test was negative.

Figure 16. Lingual aspect of the prosthetic restorations

Figure 17. Buccal aspect of the prosthetic restorations

Figure 18. Occlusal gingival profile

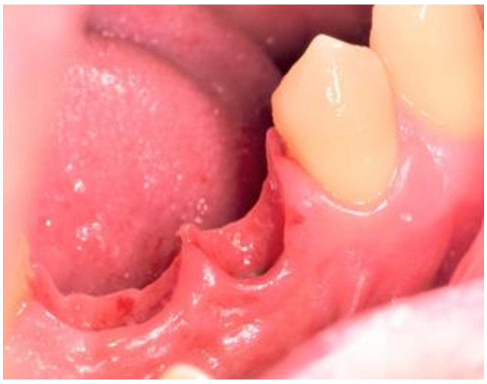

Figure 19. Gingival profile from buccal view

Conclusions

In this case management of fractured implant consists in removing the fractured part and grafting the surgical site for placing a new wider diameter implant later. Bone collected from surgical site was used to its reconstruction.

Conflict of interest: None to declare.

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