



CLINICAL ARTICLE

BONEPLANT: INNOVATION IN ALVEOLAR RIDGE ONE-STEP RECONSTRUCTION AND IMPLANTATION

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Received: Jul. 26, 2023; **Accepted:** Aug. 27, 2023; **Published:** Sep. 5, 2023

Abstract

Objectives: The aim of study was to evaluate the results of use Bone Plant implant in patients with different stages of alveolar ridges resorption.

Materials and Methods: This clinical study included 17 patients (30-78 years old) 11 maxillary and 6 mandibles, with different stages of alveolar ridges resorption, with functional and aesthetic complaints requiring and with follow up period of average 4 years.

Clinical, laboratory and computed tomography methods were used to plan implant therapy.

Total installed 19 Bone Plant implant. Loading time was approximately 4 months after surgeries. Prostheses were made in the clinic according to the generally accepted protocol. The patients were rehabilitated with a fixed prosthesis on implants with good aesthetic and functional results.

To evaluate the results of prosthetic rehabilitation, the following parameters were evaluated: implant success, prosthesis survival, implant marginal bone level (MBL). MBL was assess by digital x-ray were taken immediately and 3 months, 1 year, and 4 years after implant installation. A follow-up CT scan was performed to assess the accuracy of the implant.

Results: The postoperative periods in all patients passed without complications, there were no serious intraoperative or immediate postoperative complications. 6 months after the prosthetic rehabilitation, clinical and X-ray studies showed no signs of inflammation in the area of the implants. We had one case of implant exposure due to applying a wrong surgical technique, so we had to cover the exposed wound by doing the second surgery. Unfortunately, we lost 2 Bone Plant implant because of infection.

After 3 months loss of the marginal bone of 0.2 ± 0.25 mm (MBL), after 12 months of observation, there was a slight loss of the marginal bone over time $0,8 \pm 0.48$ mm (MBL), $1,3 \pm 0.32$. mm (MBL), after 4 years of observation. After 5 years, the effectiveness of implants was 97.4%.

Conclusion: Boneplant is an innovative product which gives us the chance to reconstruct and remodel different alveolar ridges defects, and simultaneously doing implantation, avoiding other complications of traditional techniques. Achieved graft is very reliable and gives the opportunity of loading in less period of time.

Keywords: *alveolar ridges resorption, implant restoration, Bone Plant implant*

Introduction

Alveolar bone resorption can be a physiological or pathological process and may result from tooth loss due to extraction, advanced periodontal disease or trauma, odontogenic cysts, and tumors.^{1,2}

Pronounced loss of alveolar bone can lead to violations of the ideal installation of the implant in position.

With resorption of the alveolar ridge, it is necessary to increase the size of the ridge. To increase the alveolar process in the jaw, various methods and materials are used using.³⁻¹¹

The most popular Graft Techniques are.

1. Block Grafting
2. GBR
3. SHELL Technique
4. DO (distraction osteogenesis)
5. Ridge splitting with formation of OPF

Autograft is considered as the Gold Standard for bone transplantation. When using autogenous bone block grafts, there is no risk of rejection or adverse immunological reactions but are associated with risks such as soreness of the donor site, increased postoperative discomfort, infection, and blood loss. Although good results have been reported with the use of autologous blocks.¹²

Onlay grafting with autogenous bone blocks still represents a versatile and well-documented procedure that enables the correction of any type of defect, with no limitations as regards the extent of the defect. However, the increased morbidity resulting from a frequent “second” surgical site (donor and recipient site) must be taken into consideration, and the modeling and fixation phases of the blocks require specific expertise.¹³

When used for bone grafting allografts and xenografts and they are well tolerated in intraoral procedures, they especially have better results in sinus lift and ridge augmentation procedures.^{14,15}

When using titanium micromesh with a thickness of 0.2 mm, implants for reconstructive surgery received positive results, as they have excellent biocompatibility and ease of handling, which allows them to be used for three-dimensional reconstruction of alveolar bone defects. The titanium mesh acts as a protective matrix, keeping space for the graft, and if

the mesh is exposed, it can be removed without significantly affecting the results.^{16,17}

Dental rehabilitation in edentulous patients with severe maxillary resorption has traditionally been treated with bone grafting to restore the alveolar ridge. This complex technique has a number of problems, including unpredictable medium to long term success rates and overall cost. All these techniques have some individual and some general complications and limitations.

Some of individual complications are:^{18,19}

1. Blood supply is complicated in block grafting
2. Graft stability and space maintaining is problematic in GBR
3. Lingual inclination, risk of infection, graft stability are some complications of DO
4. Stability of graft and supply of blood is complicated in ridge splitting.

General complications are:

1. They need 2 or more stages surgery
2. They are technically sensitive
3. The chance of graft contamination
4. Surgeries time increase
5. Loading time increase
6. Some of them are so traumatic.

The search for new methods and materials dictates a search for the development of less invasive approaches.

To avoiding these complications, we suggest new solution – BonePlant.

The aim of this study introducing a new special Bone Plant implant and technique for remodeling and reconstruction of alveolar ridges contained, semi contained and non-contained defects inside bone housing, simultaneously doing implants in one stage surgery, without complication of traditional techniques.

Bone Plant is a combination of cylindric allograft bone and implant fixture in one sterile package and ready to use figure 1. The size of graft part is 5 mm in high and 6 to 10 mm diameter.

Bone Plant has cylindrical shape but upper and lower margins curved. This helps for better insertion and is less traumatic for soft tissue (Figures 1, 2, 3).

The fixture diameter can be 3.3-6 mm and 8-15 mm length.

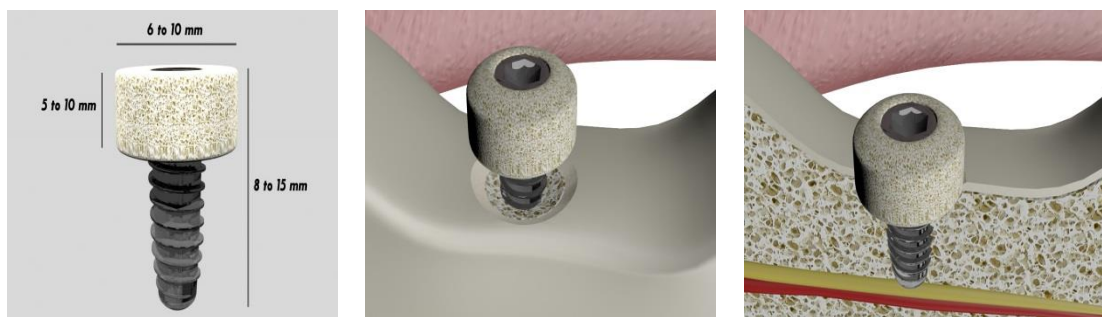


Figure 1, 2, 3: Bone Plant combination of cylindric allograft bone and implant fixture

Materials and Methods

The study is based on 17 clinical cases, 7 male and 10 female, 11 maxillary and 6 mandibles, with different stages of alveolar ridges resorption for the patients of 30-78 years old, and with follow up period of average 4 years stages of alveolar ridges contained

and non-contained defects for the patients of 30-78 years old, and with follow up period of average 4 years.

Clinical laboratory and computed tomography methods were used to plan implant therapy (Figures 4, 5, 6).

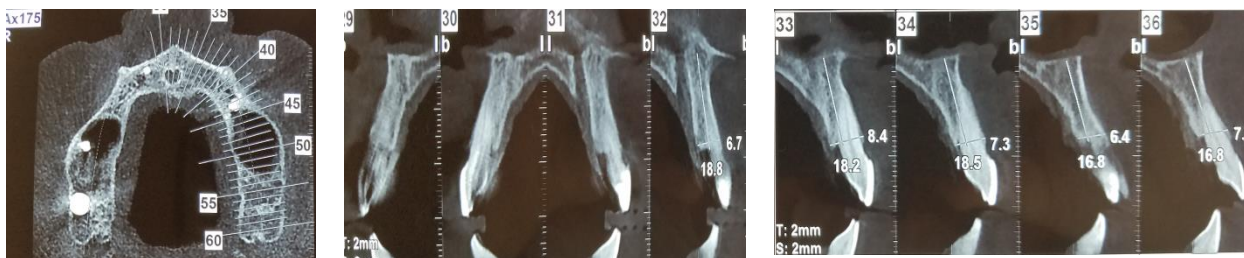


Figure 4, 5, 6: Computed tomography before implant surgery

Indications of Bone Plant

The variety of sizes and special shape of BP give us the opportunity to use it in different parts of maxilla and mandible for vertical and horizontal reconstruction and remodeling of alveolar ridge in contained, semi contained and non-contained defects, inside bone housing.

into the site and the cylindric allograft bone fills the bone defect, if necessary, the space between the graft and the maternal bone is filled with allogeneic bone filings mixed with PRP (Figures 7, 8, 9, 15, 16, 17).

Surgical technique

After the incision and exposure of the alveolar bone segment, the site of implantation is based on the anatomical restrictions, the bone site of implant is prepared, after which the implant fixture is inserted

The flap is mobilized and sutured, the sutures are removed after 7 day (Figures 10, 11).

X-ray were taken immediately and after 3 months. The patients were rehabilitated with a fixed prosthesis on implants with good aesthetic and functional results (Figures 12, 13, 14, 21, 22).



Case 1

Figures 7, 8, 9. After exposure of the alveolar bone segment, the bone site of implant is prepared, after which the implant fixture is inserted into the site and the cylindric allograft bone fills the bone defect



Case 1

Figures 10, 11. T flap is mobilized and sutured



Case 1

Figures 12, 13, 14. X-ray immediately and after 3 months. The patients were rehabilitated with a fixed crown



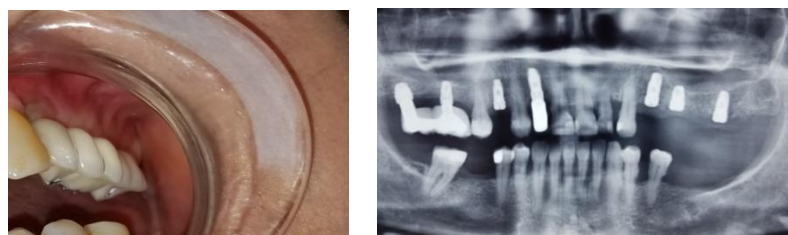
Case 2

Figures 15, 16, 17. After exposure of the alveolar bone segment, the bone site of implant is prepared, after which the implant fixture is inserted into the site and the cylindric allograft bone fills the bone defect



Case 2

Figures 18, 19, 20. Intraoral view after 4 months of implantation, gingival formers were installed, before the installation of abutments, the gingival formers were removed



Case 2

Figures 21, 22. Final prosthetics with a ceramic-metal bridge based on implants. X-ray 4 months after implantation

Patients are advised to rinse their mouth with 0.12% chlorhexidine solution for 2-3 weeks.

To evaluate the results of prosthetic rehabilitation, the following parameters were evaluated: implantation success, prosthesis survival, implant marginal bone level (MBL). MBL was assessed by digital x-ray were taken immediately (base line for comparison) and 3 months, 1 year, and 4 years after implant installation. Loading time was approximately 4 months after surgeries. Patients received 18 implant-supported prostheses.

Results

The postoperative periods in all patients passed without complications, there were no serious intraoperative or immediate postoperative complications. 6 months after the prosthetic rehabilitation, clinical and X-ray studies showed no signs of inflammation in the area of the implants.

After 3 months loss of the marginal bone of 0.2 ± 0.25 mm (MBL), after 12 months of observation, there was a slight loss of the marginal bone over time $0,8\pm 0.48$ mm (MBL), $1,3\pm 0.32$. mm (MBL), after 4 years of observation. After 5 years, the effectiveness of implants was 97.4%.

We had one case of implant exposure due to applying a wrong surgical technique, so we had to cover the exposed wound by doing the second surgery. Unfortunately, we lost BP because of infection. All the other 16 BPs have been integrated successfully and we load them 4 months after implantation.

Discussion

A severely atrophied maxilla presents serious limitations for conventional implant placement. Treatment of severely atrophied posterior jaws with standard length implants is a challenge. In these clinical situations, bone reconstructive surgery is the treatment of choice;²⁰⁻²⁵ however, not all patients are willing to accept these methods for different reasons.

This complex technique has a number of problems, including unpredictable medium to long term success rates, associated morbidity, duration of treatment (due to waiting times for graft consolidation and implant

osseointegration, among other reasons), and overall cost.

For severe bone resorption in the jaw where the patient does not want to undergo bone regeneration, current technologies may represent a viable solution to this problem adapted to their local morphology and anatomy.

In patients with compromised general health who require extensive augmentation procedures, minimally invasive techniques should be considered. Therefore, researchers in the field of implantology are developing and adopting new less invasive methods to reduce the risk of reconstructive procedures.^{26,27}

Thanks to modern new innovative technologies for designing and manufacturing implants in patients with severe jaw resorption, new opportunities for orthopedic rehabilitation open up. Short implants represent a promising approach for patients with severe atrophy to avoid augmentation procedures.^{28,29} This method is simpler and faster as it does not require the use of grafts and thus significantly reduces the treatment time.³⁰⁻³² However, some researchers are pessimistic about the use of short implants noting the risk of losing short implants due to the limited surface.

For this reason, the search for new implant methods and implants of new designs is relevant. Based on this, we developed an original Bone Plant implants showed its effectiveness after more than 6 years of observation.

Advantages of Bone Plant

Simultaneously implants in one stage surgery avoiding traditional techniques complications.

1. Better stability according to fixation of Graft part due at least 3.35 mm diameter fixture itself, not by small 1.2-1.5 mm titanium screws
2. Better space maintaining
3. Better supply of blood: here we have 3 source of vascularization alveolar bone surface –periosteum and cancellous part of alveolar ridge due fixture threads. So, we have better and faster angiogenesis

These peculiarities lead to formation of more reliable Osseo integrated graft in less period of time. According to results of CBCT we have minimum 5 mm vertically and 6-9 mm horizontally ridge reconstruction.

Other advantages

1. Better Graft – Implant and Graft – Ridge contact, minimum space between them
2. One stage grafting and implantation decrease the surgeries quantities
3. Simple handling even for DDS so decrease surgeries time
4. Ability to use in different locations
5. Loading time decrease
6. BP is less traumatic

BonePlant usage limitation

Insufficient vertical and horizontal ridge for primary implant stability. We need at least 4 mm vertical and 5 mm horizontal bone for good primary implant stability.

Bone Plant intention technique

It is the same as simple implantation, all processes are similar to implant intention. Here we just need to have exact evolution of defect size and choose appropriate Bone Plant.

Conclusion

Boneplant is a new innovative implant which gives us the chance to reconstruct and remodel different

alveolar ridges defects, and simultaneously doing implantation, avoiding other complications of traditional techniques. Achieved graft is very reliable and gives the opportunity of loading in less period of time.

Declarations

Conflicts of interest and financial disclosures

The author declares that he has no conflict percent and there was no external source of funding for present research.

Source of funding

The work was not funded.

Ethical approval

The study was approved by the University ethics committee and was conducted in accordance with the Declaration of the World Medical Association. Informed consent Patients were informed verbally and in writing about the study and gave written informed consent.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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BONEPLANT. ՆՈՐԱՐԱՐՈՒԹՅՈՒՆ ԱՏՄՆԱԲՆԱՅԻՆ ԵԼՈՒՆԻ ԱՊԱՃԻ ՎԵՐԱԿԱՆԳՆՄԱՆ և ԻՄՊԼԱՆՏԱՑԻԱՅԻ ՄԵՉ ՄԵԿ ՔԱՅԼՈՎ

Էդվին Ռոստամի¹

¹ քերանի խոռոչի և դիմաձնոտային վիրաբույժ, Հիմնադիր, տնօրեն «Իմպերիալ իմպլանտ կենտրոն» ՍՊԸ, Երևան, Հայաստան

Ամփոփում

Նպատակները. Ուսումնասիրության նպատակն էր գնահատել BONEPLANT-ի կիրառման արդյունքները ատմնաբնային ելունի տարբեր աստճիանի ապաճի վերականգնում ցուցված է հիվանդների մոտ:

Նյութեր և մեթոդներ. Այս կլինիկական ուսումնասիրությունը ներառում էր 17 հիվանդ (30-78 տարեկան) 11 վերին և 6 ստորին ծնոտ, ատմնաբնային ելունի ապաճի տարբեր աստճիանի, ֆունկցիոնալ և էսթետիկ գանգատներով, հսկողական ժամանակահատվածը՝ միջինը 4 տարի:

Իմպլանտացիայի պլանավորման համար օգտագործվել են կլինիկական, լաբորատոր և համակարգչային տոմոգրաֆիայի մեթոդներ:

Ընդհանուր տեղադրվել են 49 Bone Plant իմպլանտ: Բեռնման ժամանակը վիրահատությունից հետո մոտավորապես 4 ամիս էր: Կլինիկայում պատրաստվել են պրոթեզներ՝ ընդհանուր ընդունված արձանագրության համաձայն: Հիվանդները վերականգնվել են իմպլանտների վրա տեղադրված ֆիքսված պրոթեզով՝ լավ էսթետիկ և ֆունկցիոնալ արդյունքներով:

Իմպլանտացիայի արդյունքները գնահատվել են հետևյալ պարամետրերով՝ իմպլանտի հաջողություն, պրոթեզի գոյատևում, իմպլանտի եզրային ոսկրային մակարդակ (MBL): MBL-ը գնահատվել է թվային ռենտգենով իմպլանտի տեղադրումից անմիջապես հետո 3 ամիս, 1 տարի և 4 տարի անց: Իմպլանտի ճշգրտությունը գնահատելու համար իրականացվել է հետագա CT սկանավորում:

Արդյունքները. Բոլոր հիվանդների մոտ հետվիրահատական շրջաններն անցել են առանց բարդությունների, լուրջ ներվիրահատական կամ անմիջական հետվիրահատական բարդություններ չեն եղել: Պրոթեզավորմից 6 ամիս անց կլինիկական և ռենտգեն հետազոտությունները իմպլանտների շուրջ բորբոքման նշաններ ցույց չեն տվել: Մենք ունեինք իմպլանտի մերկացման մեկ դեպք սխալ վիրահատական տեխնիկայի կիրառման պատճառով, ուստի ստիպված եղանք ծածկել բաց վերքը՝ կատարելով երկրորդ վիրահատությունը: Ցավոք, մենք կորցրինք 2 ոսկրային բույսի իմպլանտը վարակի պատճառով:

3 ամիս հետո մարզինալ ոսկորի կորուստը եղել է $0,2 \pm 0,25$ մմ (MBL), 12 ամիս դիտարկումից հետո մարզինալ ոսկորի կորուստը եղել է $0,8 \pm 0,48$ մմ (MBL), $1,3 \pm 0,32$ մմ (MBL), 4 տարվա դիտարկումից հետո, 4 տարի անց իմպլանտների արդյունավետությունը կազմել է 97,4%:

Եզրակացություն. Boneplant-ը նորարարական իմպլանտ է, որը մեզ հնարավորություն է տալիս ատմնաբնային ելունի տարբեր աստճիանի ապաճով հիվանդների մոտ միաժամանակ կատարել վերականգնում և իմպլանտացիա՝ խուսափելով ավանդական տեխնիկայի այլ բարդություններից: BONEPLANT-ի կիրառումը շատ հուսալի է և հնարավորություն է տալիս իմպլանտը բեռնել ավելի քիչ ժամանակում:

BONEPLANT: ИННОВАЦИИ В ОДНОЭТАПНОЙ РЕКОНСТРУКЦИИ И ИМПЛАНТАЦИИ АЛЬВЕОЛЯРНОГО ОТРОСТКА

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Абстракт

Цель исследования — оценить результаты применения имплантата Bone Plant у пациентов с разной стадией резорбции альвеолярного отростка.

Материалы и методы. В это клиническое исследование были включены 17 пациентов (30-78 лет) 11 верхней и 6 нижней челюсти, с разной стадией резорбции альвеолярных отростков с функциональными и эстетическими жалобами, требующими реконструкции, со сроком наблюдения в среднем 4 года.

Для планирования имплантационной терапии использовались клинические, лабораторные и компьютерно-томографические методы.

Всего установлено 49 имплантатов Bone Plant. Время загрузки составило примерно 4 месяца после операции. Протезы изготавливались в клинике по общепринятому протоколу. Пациенты были реабилитированы несъемным протезом на имплантатах с хорошими эстетическими и функциональными результатами.

Для оценки результатов ортопедической реабилитации оценивались следующие параметры: успех имплантата, приживаемость протеза, уровень маргинальной кости имплантата (MBL). MBL оценивали с помощью цифрового рентгеновского снимка сразу, а также через 3 месяца, 1 год и 4 года после установки имплантата. Последующая компьютерная томография была выполнена для оценки точности имплантата.

Полученные результаты: Послеоперационные периоды у всех больных протекали без осложнений, серьезных интраоперационных и ближайших послеоперационных осложнений не было. Через 6 месяцев после ортопедической реабилитации клинические и рентгенологические исследования не выявили признаков воспаления в области имплантатов. У нас был один случай обнажения имплантата из-за применения неправильной хирургической техники, поэтому нам пришлось закрыть открытую рану, сделав вторую операцию. К сожалению, мы потеряли 2 имплантата Bone Plant из-за инфекции.

Через 3 мес потеря маргинальной кости $0,2 \pm 0,25$ мм (МКК), через 12 мес наблюдения отмечена незначительная потеря маргинальной кости с течением времени $0,8 \pm 0,48$ мм (МКЛ), $1,3 \pm 0,32$ мм (MBL), через 4 года наблюдения. Через 5 лет эффективность имплантатов составила 97,4%.

Заключение: Boneplant – это инновационный имплант, который дает нам возможность реконструировать различные дефекты альвеолярного отростка, одновременно проводя имплантацию, избегая других осложнений традиционных методик. Boneplant очень надежен и дает возможность нагрузки за меньшее время.