

The Method of Autobone Grafting For Atrophy of the Alveolar Process of the Lower Jaw

Shirynbek Ilyas

South Kazakhstan Medical Academy

Faiziev B. R.

Tashkent State Dental Institute

Abdukarimov N. M., Achilova N. G.

Fergana Medical Institute of Public Health

Article Information

Received: December 26, 2022

Accepted: January 27, 2023

Published: February 28, 2023

Keywords: *atrophy of the alveolar process, dental implantation, autologous implant, augmentation.*

ABSTRACT

The use of dental implants as a support for prostheses and crowns is difficult due to bone atrophy of the alveolar process. Low-traumatic flap exfoliation and two-layer wound closure allow increasing the thickness of soft tissues in the intervention area. Thus, according to Istvan A. Urban, there is no need for early transplantation of gingival grafts. The purpose of this study was to study and evaluate the effectiveness of the method of autologous bone grafting to increase the volume of bone tissue in atrophy of the alveolar ridge.

Relevance of the topic. The use of dental implants as a support for prostheses and crowns is difficult due to bone atrophy of the AO (alveolar process). The reason for this state of AO is in 65% of cases a long-term absence after extraction of teeth, incompetent extraction - 20%, traumatic injuries of the jaw bones - 13%, careless plastic surgery on the bones - 7%.

The proportion of primary patients with AO atrophy and the need for preoperative bone-reconstructive interventions before dental implantation itself is more than 60% [1, 2, 6].

The bone of the alveolar process is considered to be inactive in terms of functional properties, a zone devoid of teeth, since it does not experience chewing load. There is a tendency to reduce the efficiency of gingival microcirculation during the extraction of a single tooth by 13%, with the removal of several by 25%.

Significant atrophy of the alveolar ridge leads to a significant decrease in the intensity of blood flow, which, in turn, adversely affects both the healing processes in soft tissues and the stage of osteogenesis repair with implanted bone [3, 4, 5, 8].

With atrophy, there is a lack of bone volume and a deficit of soft tissues, which creates certain inconveniences during guided bone regeneration (GBR). These principles require preliminary

planning of the shape of the mucoperiosteal flap (PRF), and in most cases, additional laxative incisions are required to avoid tension during wound closure [7, 9].

The identification of key aspects that determine the result of surgical interventions to compensate for the lack of bone volume has been going on for a long time based on the results of clinical observations and scientific research.

E.E. Keller et al. noted that one should also pay attention to the exact incision and the correct location of the flap, sparing exfoliation of the periosteum, compliance with the temperature regime in order to avoid overheating of both the receiving bed and the autograft, etc.

Low-traumatic flap exfoliation and two-layer wound closure allow increasing the thickness of soft tissues in the intervention area. Thus, according to Istvan A. Urban, there is no need for early transplantation of gingival grafts.

Tight, tension-free suturing is a key factor in the success of osteoreparation processes. It is necessary to apply unloading horizontal and vertical mattress sutures in addition to single nodal ones. Thread - monofilament, to maintain adequate hygiene. Sutures are removed no earlier than 10-15 days after the operation.

Thus, the above factors necessitate the development of optimal methods for increasing the volume of soft tissues in the area of the planned osteoplastic surgery.

The purpose of this study was to study and evaluate the effectiveness of the method of autologous bone grafting to increase the volume of bone tissue in atrophy of the alveolar ridge.

Materials and methods of research

The study involved 32 patients with partial secondary adentia and atrophy of the alveolar ridge (more than 4 mm), who applied to the Department of Surgical Dentistry of the clinic of the South Kazakhstan Medical Academy (Shymkent, Kazakhstan). The age of the patients varied from 38 to 60 (mean age 48.6 ± 7.2 years).

The criteria for exclusion of patients from the study were as follows: age under 18 and over 75 years old, complete edentulism of both jaws, metabolic diseases (uncontrolled diabetes, etc.), pregnancy or lactation, uncontrolled periodontitis, chronic diseases at the stage of decompensation, oncological diseases, radiation therapy in the head and neck, impaired hemostasis, anticoagulant therapy, allergy to the materials used, current smoking habit and poor oral hygiene, ongoing treatment with drugs that affect bone metabolism (bisphosphonate, recombinant parathyroid hormone and denosumab), drug and alcohol addiction, mental illness, taking immunosuppressive drugs and corticosteroids, severe bruxism, autoimmune and inflammatory diseases of the oral cavity, AIDS, hepatitis C, tuberculosis.

All 32 patients included in the study had atrophy in the lower jaw along the alveolar ridge with this pathology and needed an increase in the height and / or width of the ridge by more than 4 mm with an insufficient amount of soft tissues.

After a clinical examination and verification of the compliance of patients with the inclusion criteria in the study, a treatment plan was drawn up and, depending on the tactics of the formation of the mucoperiosteal flap, the subjects were divided into 2 groups:

Group 1 - 16 patients - SNL was formed by the traditional method: making a trapezoidal incision in the reconstruction area ("open" surgical approach);

Group 2 - 16 patients - a bone block and auto chips were taken with fixation of the bone block and collagen membrane, as well as bone chips on the implanted bed.

Our technique differs significantly from the classical technique of Professor Curie in that the

volume of the donor bone is smaller, thereby causing less trauma. It also differs significantly from the Inlay technique using the xenogenic bone block of Professor Pietro Felici in that there is much less risk of periosteal rupture or subsequent intussusception, trauma to the mandibular nerve during fixation of bone blocks with bone screws and plates, since the flap does not peel off completely.

Depending on the required volume of soft tissue expansion, 3 types of autograft were used, differing in volume and design (Table 1).

In NKR, a mixture of autograft (bone chips) from the retromolar region and Bone-D XB xenomaterial (MedPark, South Korea) in a ratio of 1:1 was used for the reconstruction of the alveolar ridge.

Table 1. Dimensions of xenomaterial before and after replanting

Options	TEX007		TEX010		TEX021	
	before	after	before	after	before	after
L, mm	12	20	13	22	15	24
D, mm	4	7	5	9	6	11
V, mm	0,15	0,7	0,25	1,3	0,42	2,1

Note: L - length, D - width, V - volume.

During control examinations, pain reactions after surgery were analyzed according to the NRS-numerical rating scale (Numerical Rating Scale, 2018). This technique specifies the intensity of pain:

Table 2. Characterization of the intensity of the pain symptom on the NRS scale

№	Numerical value	The severity of the pain symptom
1	0	no pain
2	1, 2, 3	mild pain
3	4, 5, 6	moderate pain
4	7, 8, 9, 10	severe pain

The main attention was paid to the use of quantitative indicators of the dose of painkillers taken in the postoperative period during the 1st, 7th and 14th days.

We paid attention to the volume of collateral edema, took into account the incidence of complications after NCR.

The study of the mucous membrane of the recipient zone was carried out during control examinations - visual monitoring of the intensity of the spread of collateral edema, hyperemia and hyperthermia of soft tissues was carried out. Instrumental methods (ultrasound, LDF, 3D-scanning) were also used to more accurately assess changes in the volume of soft tissues, the state of microcirculation, etc.

Ultrasound examination of the expander insertion area was performed using the E-CUBE 9 Diamond imaging system (Alpinion medical systems®, South Korea). To assess the thickness of the attached gingiva, an IO3-12 intraoral probe (frequency 3~12 MHz) was used. Changes in tissue expander volume and gingival thickness above the expander were measured by assessing height and width during expansion at 3–5 mm intervals; then their average values were calculated.

In all patients, alginate impressions were obtained and models of the recipient zones were made at the initial stage (preoperative, during the initial examination) and at the end of soft expansion. The casts were scanned using a Cerec 3D optical scanner (Sirona Dental Systems GmbH,

Germany), and the resulting images were imported into Geomagic Studio® 2013 CAD software (Raindrop Geomagic, North Carolina, USA) to assess changes in soft tissue dimensions

It is changes in microcirculatory blood flow on the mucosa of AG in the projection of the proposed implantation and the same other side, the method of laser Doppler flowmetry (LDF) was used, which was carried out on the analyzer "LAKK-02" (Russia).

Statistical data processing included a software package for biomedical research. The data were entered into specially compiled tables in the Microsoft Office Excel 2010 program for the Windows XP operating system, as well as the statistical software package Stat Soft Statistica v6.0. The same programs were used to construct graphs and charts to visually illustrate the change and interrelation of the statistical data of the study.

Research results and discussion

After detachment of the mucoperiosteal flap, a bone block is taken from the branch of the lower jaw less than with the Curie method. On the recipient bed, it is not necessary to carry out decortication with a drill, it is enough to take the chips with a bone scraper. At the peak of the alveolar ridge in the most atrophied area, an autoblock 5 mm high and long enough to eliminate the defect is fixed.

The gap between the autoblock and the receiving bed is also corrected by the doctor. Bone chips fill the gap for better vascularization. Departing from the fixed block, a xenogenic osteoplastic material impregnated with PRP is placed.

The laid xenogenic osteoplastic material is covered with a collagen membrane without touching the bone autoblock. The membrane is fixed with impactless pins, thereby simplifying the doctor's work and reducing the patient's psycho-emotional stress. Having secured fixed the membrane, it is possible to carefully split the periosteum from the vestibular flap. Having mobilized the flap, it is sutured with U-shaped and interrupted sutures, preferably with non-resorbable threads.

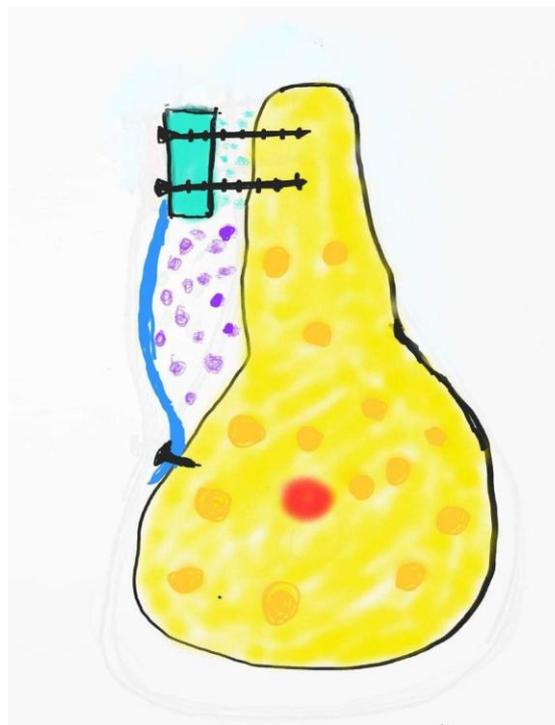


Figure 1. Collection of bone block and autoshavings. Fixation of the bone block and bone chips on the bed.

The advantage of this method is that by injuring less, we get the desired result in the desired

section of the atrophied area.

The collected tissues have a similar morphology with the recipient zone and also have local immunity to the aggressive microflora of the oral cavity. Well suited for patients with thin gum biotype. Even if the flap is exposed, the autoblock is not contaminated by saliva, like foreign materials.

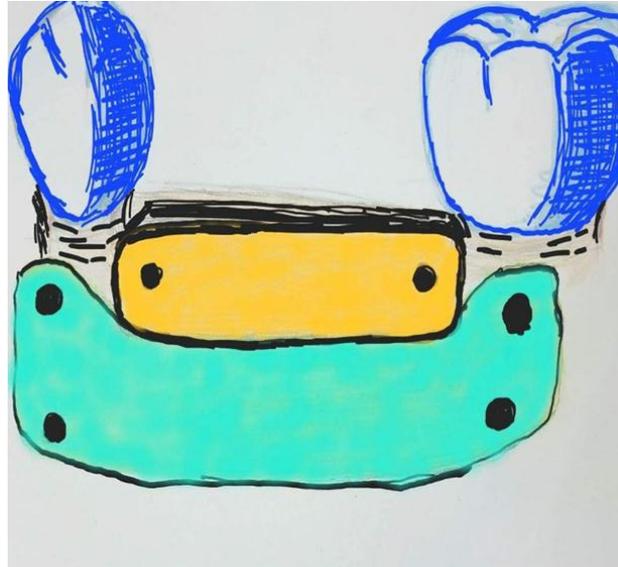


Figure. 2 Fixation of the collagen membrane. Xenomaterial planting

The dilator was handled carefully, holding its flat end with tweezers.

The sutures were removed during the follow-up examination 14 days after the introduction of the dilator. The final expanded volume was obtained after 28 days and then proceeded to the implementation of the NCR.

During follow-up examinations, patients had no complaints of discomfort, pain, or redness of the mucous membrane in the area of autograft injection.

The soft tissue expansion resolved without signs of inflammation, rupture, or injury (Figure 3). No mucosal perforation was observed. When the autograft was introduced into the soft tissues on the bone surface of the recipient zone, no signs of potential resorption due to pressure were found (Figure 4. b).



Drawing. 3. Clinical example. Patient S., 45 years old with atrophy of the frontal region of the dentition: a - donor zone, b - detachment of the muco-periosteal layer



Drawing. 4. View of the area of augmentation with bone blocks

In our practice, there have been several clinical cases where mucosal ruptures occurred due to improper mobilization or very thin mucosa. It is enough to grind the surface under cooling the surface of the bare plate and sew it in again.

Cone beam computed tomography. In the area of 1.2 teeth before autologous grafting according to the type of proposed technique: the height of the alveolar process is more than 14 mm, the width is 3.5 mm. The cortical layer in all departments is well expressed, the density of the spongy substance is homogeneous.

After autologous grafting: the linear dimensions of the alveolar process are preserved, the density of the cortical layer and spongy substance is preserved. The autograft is well mineralized, the thickness of its completely viscous shell did not become thinner after tissue expansion. Thus, the value of this indicator before expansion was 1.52 ± 0.12 mm, and after expansion it was 1.45 ± 0.24 mm, which indicates a minimal clinical risk of tissue divergence and injury during expansion (Figure 5)

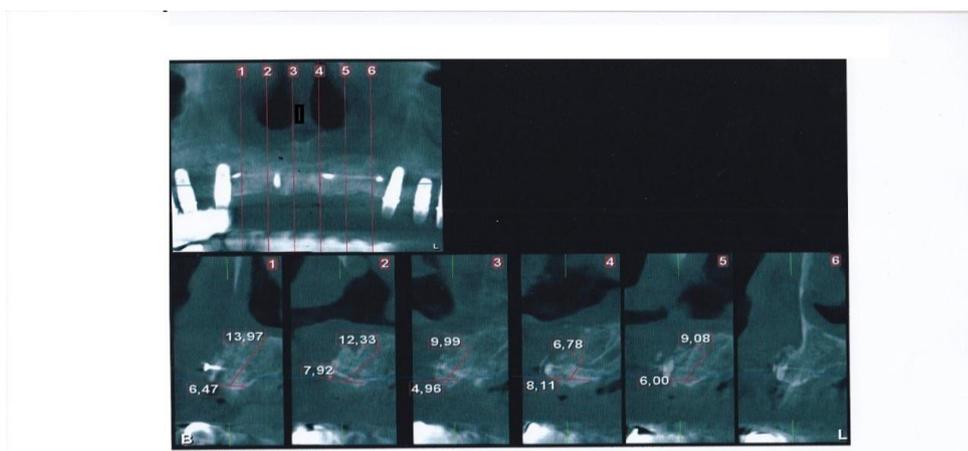


Figure.5. CBCT of patient K. Good result 6 months after autologous bone grafting

The results of LDF before the introduction of the autograft into the microvascular bed showed a decrease in the modulation of tissue blood flow and worse venous outflow (an increase in pulse fluctuations by 10%). Vascular tone was reduced compared to the symmetrical side, suggesting vasoconstriction. On the mucous membrane of the AO, a decrease in the share of microcirculation was revealed, which occurs due to the deterioration of masticatory pressure in

these areas.

Table 3. Characteristics of changes in blood flow in the area of implantation before and after the introduction of an autograft, (M±m)

Options	Dates of observations				Norm	Symmetrical side (control)
	before the introduction	later 3 days	through 14 days	on 28th day		
M , conventional units	10,88±0,25	16,8±0,3	14,64±0,2	15,45±0,25	18-20	15,48±0,3
σ , conventional units	1,35±0,05	1,88±0,02	1,68±0,04	1,79±0,02	1,8-2,2	2,05±0,03
K_v , %	9,25±0,82	10,16±0,4	13,53±0,5	12,62±0,4	12-15	13,56±0,2
A_{LF}/σ , %	114,4±10,2	136,5±4,8	133,5±9,5	120,5±6,4	144,0±16	106,8±10,2
σ/A_{LF} , %	91,7±6,3	88,4±7,2	98,4±4,2	82,2±3,1	74,0±9,0	100,7±4,3
A_{HF}/σ , %	61,4±8,4	65,8±4,2	61,6±8,2	60,6±3,6	69,0±8,0	59,4±4,4
A_{CF}/σ , %	30,3±6,6	34,5±1,7	38,8±1,4	27,8±3,2	37,0±7,0	35,5±3,5
fluxmotion index	1,24±0,06	1,25±0,05	1,3±0,1	1,4±0,2	1,42±0,12	1,25±0,05

Note: ALF/σ – vasomotion, σ/ALF – vascular tone, AHF/σ – high-frequency fluctuations, ACF/σ – pulse fluctuations, IFM – fluxmotion index (ALF/(AHF+ACF))

Since, at any surgical stage, there is collateral edema, it was noted in all the subjects, but to varying degrees. A similar termination of collateral edema was observed in both examined groups. These indicators on the 1st day of surgery, equal to the average, an increase in the development of edema on the 3rd day and a relatively uniform decline until the final disappearance in the postoperative period over the next two weeks.

In the postoperative period, the time period of the healing process of the wound surface after NKR was monitored, this turned out to be approximately the same in all the studied patients. It should be noted that in patients of the 2nd group (preliminary expansion of the soft tissues of the recipient area was carried out), healing was somewhat faster: on the 10th day of observation, the proportion of patients with complete healing was 40%, while in the 1st group this indicator averaged 18%. The average healing time in the 1st group was 14.5±0.5 days, in the 2nd group - 12±0.5 days.

Thus, the use of the method of autologous grafting in case of atrophy of the alveolar process of the lower jaw in the area of the planned NKR allows to obtain a sufficient increase in tissues, which, in turn, eliminates the need for laxative incisions - a factor in additional traumatization of surrounding tissues.

Conclusions:

Stably normal microcirculation indicators provide optimal conditions for regeneration and formation of bone tissue with sufficient density and volume, which leads to high primary stabilization of dental implants at the stage of their installation. The above significantly increases the effectiveness of the implant treatment.

Bibliography:

1. Beniashvili R.M. Gingival and bone grafting in dental implantology / R. M. Beniashvili [et al.]. - M.: GEOTAR-Media, 2017. - P .240

2. Shirynbek I., Pulatova B.Zh., Shukparov A.B., Shomurodov K.E. On the issue of studying the factors of bone augmentation stability. *Medicine and innovations*, vol. 1, no. 3, January 2022, p. 151-160, doi:10.34920/min.2021-3.021.
3. Eisenbraun O.V. The use of tunnel technique of bone grafting in patients with atrophy of the bone tissue of the jaws: diss. ... Candidate of Medical Sciences. - Moscow, 2018. - 257 p.: ill.
4. Byun S-H, Kim S-Y, Lee H, et al. Soft tissue expander for vertically atrophied alveolar ridges: Prospective, multicenter, randomized controlled trial. *Clin Oral Impl Res.* 2020;31:585–594. <https://doi.org/10.1111/clr.13595>
5. Collins, T. A. Team management of atrophic edentulous with autogenous inlay, veneer, and split grafts and endosseous implants: case reports / T. A. Collins, G. K. Brown, N. Johnson, J. A. Massey, B. D. Nunn // *Quintessence Int.* – 1995. – № 26 (2). – P. 79-93.
6. Khasanov I. I., Rizaev J. A., Abduvakilov J. U., Shomurodov K. E., Pulatova B. Z. Results of the study of indicators of phosphorus-calcium metabolism in patients with partial secondary adentia // *Annals of the Romanian Society for Cell Biology.* – 2021. – C. 251-258.
7. Park, S. H., Choi, S. K., Jang, J. H., Kim, J. W., Kim, J. Y., Kim, M. R., & Kim, S. J. (2013). Self-inflating oral tissue expander for ridge augmentation in the severely atrophic mandible. *Journal of the Korean Association of Oral and Maxillofacial Surgeons*, 39, 31–34. <https://doi.org/10.5125/jkaoms.2013.39.1.31>
8. Urban IA, Monje A. Guided Bone Regeneration in Alveolar Bone Reconstruction. *Oral Maxillofac Surg Clin North Am.* 2019;31(2):331-338. doi:10.1016/j.coms.2019.01.003.
9. Zhao X, Zou L, Chen Y, Tang Z. Staged horizontal bone augmentation for dental implants in aesthetic zones: A prospective randomized controlled clinical trial comparing a half-columnar bone block harvested from the ramus versus a rectangular bone block from the symphysis. *Int J Oral Maxillofac Surg.* 2020;49(10):1326-1334. doi:10.1016/j.ijom.2019.12.010.