International Journal of Dentistry and Oral Science (IJDOS)
ISSN: 2377-8075

Elimination Of Post-Extraction Atrophy And Deformation Of The Alveolar Part Of The Jaw By Injecting Osteoplastic Materials

Research Article

Bezrukov S.G[1], Shepelev A.A[2], Bezrukov G.S[3], Odilbekov U.A[4], Yelcheva L.A[5*]

[1] Head of the Department of Surgical Dentistry and Maxillofacial Surgery, Professor, Faculty of Dentistry of the Medical Academy named after S. I. Georgievsky of Vernadsky CFU, Simferopol, 95000, Russian Federation.
[2] Surgeon Dentist-Implantologist, Dental Clinic "Apex-Plus", Sevastopol, 99000, Russian Federation.
[3] Docent of the Department of Pediatric Dentistry, Faculty of Dentistry of the Medical Academy named after S. I. Georgievsky of Vernadsky CFU. Simferopol, 95000, Russian Federation.
[4] Resident Faculty of Dentistry of the Medical Academy named after S. I. Georgievsky of Vernadsky CFU, Simferopol, 95000, Russian Federation.
[5] Senior Teacher of the Department of Surgical Dentistry and Maxillofacial Surgery, Faculty of Dentistry of the Medical Academy named after S. I. Georgievsky of Vernadsky CFU, 95000, Russian Federation.

Abstract

Post-extraction atrophy and deformation of the alveolar ridge of the jaws continues to be a serious problem in dentistry. Surgical treatment of these conditions is associated with the need to use autoplastic material, which causes certain difficulties. The injectable route of administration of osteoplasts seems to be less traumatic. However, to date, it has not found its wide application. The aim of the study was to evaluate the effectiveness of the method of eliminating post-extraction atrophy and deformation of the alveolar process by injecting osteoplastic materials on the example of platelet-rich autoplasma (PRP) and a suspension of a synthetic osteoplastic drug (Collapan). 68 patients with a limited postextraction defect or atrophy of the alveolar part of the jaw were treated and examined. Osteoplastic materials (PRP and Collapan) were injected into the bone defect area under the periosteum. In the conditions of the clinic, the effectiveness of the proposed injection method of combined administration of osteoplastic materials was established, which is expressed in the activation of bone regeneration processes with partial restoration of the lost volumes of the alveolar ridge, which is achieved due to the increased concentration in PRP of a complex of growth factors that ensure the implementation of the osteoinductive functions of the used graft, as well as the osteoconductive effect of a synthetic bioresorbable bone drug (Collapan).

Keywords: Postextraction Atrophy And Deformation Of The Alveolar Ridge; Treatment; Osteoplastic Materials; Injection Route Of Administration.

Introduction

One of the main tasks of modern dentistry is to restore the integrity of the dentition and the function of chewing. Prosthetic dentistry, having reached a high level in the use of modern technologies in the manufacture of permanent structures and removable dentures, is not always able to effectively solve the tasks, due to the fact that this is prevented by post-extraction atrophy and deformation of the alveolar ridge of the jaw. It is known that within the first year after tooth extraction, the alveolar process loses up to 70% of the bone tissue volume, which leads to a decrease in the aesthetics of permanent structures and the fixation of removable ones, and also often are a contraindication to the use of dental implantation. Surgical removal of postextraction atrophy and deformation of the alveolar part of the jaw is widely used for pre-prosthetic and pre-implantation preparation of a dental patient with both generalized and local (in the projection of 1-3 teeth) pronounced bone tissue deficiency [7]. However, this method has significant limitations due to the need for the preparation and use of autografts [1, 2, 8]. The injectable route of administration of osteoplasts seems to be less traumatic. At the same time, to date, it has not found its wide application. The

***Corresponding Author**:
Yelcheva L.A,
Senior Teacher of the Department of Surgical Dentistry and Maxillofacial Surgery, Faculty of Dentistry of the Medical Academy named after S. I. Georgievsky of Vernadsky CFU, 95000, Russian Federation.
Tel: +79787253877
E-mail: lidayelcheva@gmail.com

Received: September 18, 2021
Accepted: November 13, 2021
Published: November 23, 2021

Citation: Bezrukov S.G, Shepelev A.A, Bezrukov G.S, Odilbekov U.A, Yelcheva L.A. Elimination Of Post-Extraction Atrophy And Deformation Of The Alveolar Part Of The Jaw By Injecting Osteoplastic Materials. *Int J Dentistry Oral Sci.* 2021;8(11):5101-5103. doi: http://dx.doi.org/10.19070/2377-8075-210001026

optimal dosage and depth of the location of osteoplastic materials have not been clarified. In addition, the effectiveness of both monotherapy and combined use of bone regenerants during their injection has not been studied [3].

The purpose of the study. Evaluation of the effectiveness of the method for eliminating post-extraction atrophy and deformation of the alveolar ridge of the jaw by subperiosteal injection of osteoplastic materials on the example of platelet-rich autoplasma (PRP) and a suspension of a synthetic osteoplastic drug (Collapan).

Materials and Methods

68 patients with a limited postextraction defect or atrophy of the alveolar part of the jaw were treated and examined. In the control group (n=30), correction of the shape of the alveolar process was performed using subperiosteal injections of platelet-rich plasma. Depending on the prevalence of the sections of local bone atrophy, from 2 to 4 ml of PRP was administered simultaneously. In the main group (n=38), local injectable augmenting therapy was carried out by combined subperiosteal administration of PRP and a suspension of a synthetic osteoplastic drug (Collapan). At the same time, osteoplasts were used separately in equal doses. Primarily, plasma enriched with platelets (1-2 ml) was injected and then (after 1-2 minutes) a suspension of fine powder Collapan was placed under the periosteum in an isotonic sodium chloride solution (in a ratio of 1:2) with a volume of 1-2 ml. All manipulations were performed under infiltration local anesthesia with 0.5 % lidocaine solution (2-3 ml). To achieve the planned therapeutic osteoplastic result, the patients underwent additional injection procedures (but no more than three), with a break of 2 weeks.

Platelet-rich plasma was obtained from the patient's blood, which was taken from the ulnar vein with a disposable needle - catheter into 2-4 sterile vacuum tubes (9 ml each). Such a volume of blood loss (only from 18 to 36 ml) is considered insignificant, it is mild by the patient, does not require the appointment of additional therapy. To inhibit hemocoagulation, 0.05 ED of heparin was previously injected into each tube. Hermetically sealed containers were placed in a centrifuge (Hettich Eva-20, Germany). The blood was centrifuged in two stages: 10 minutes at 2000 rpm (plasma with a low platelet content was obtained in the upper layer and taken with a syringe), then another 15 minutes at 4000 rpm (plasma enriched with platelets was collected in the upper layer, it was also collected in a syringe). 1-1.3 ml of PRP was taken from each tube. The resulting material was injected subperiosteally using an insulin syringe (1 ml volume) with a non-removable needle. Patients in the main group, the PRP was prepared by the above procedure, but was introduced into the subperiosteal space at half the dose (in comparison with the control group), followed by a second syringe through a needle with a wide diameter (0.5 mm) in the same plot were injected the same amount of a suspension of fine osteoplastic powder (Collapan) in isotonic sodium chloride solution (ratio 1:2).

The basis of the methods of treatment used in our work, lay down recommendations for the use of PRP present in the available literature and instructions for use of the drug Collapan [3-6, 9].

Stomatological examination of patients included examination of the face and dentition. During the treatment, attention was paid to the nature of post-injection pain sensations, the duration of the course of local inflammatory reactions. The condition of the tissues in the injection site was evaluated, the result of palpation of periodontal tissues, the density of post-injection infiltrate (regenerate) formed in the area of the osteoplastic material location were taken into account. To determine the optical density of the bone (according to the method of Vagin P. V., 2012) and the nature of the structural changes occurring in it, the methods of orthopantomography and computed tomography were used. The criteria for including patients in the study were: diagnosed local (within 1-3 missing teeth) post-extraction moderate atrophy and/or deformation of the alveolar part of the jaw: the age of patients (20-50 years), informed consent of the patient. The exclusion criteria were severe general somatic diseases: diabetes mellitus, chronic renal failure, severe anemia, heart and respiratory failure, oncological diseases, urgent conditions, as well as the patient's refusal to participate in the study at any stage.

Results and Discussions

One day after injection osteoplasty, the analyzed signs were present in most of the representatives of the comparison groups without significant differences. Significant intergroup differences were detected from the 2nd to the 5th-6th day of treatment and were registered for all the analyzed signs. Moreover, local post-injection reactions were more pronounced in the main group, where combined subcostal administration of osteoplastic drugs was used. This tissue reaction was predictable for us, because the proposed method, in addition to using two dissimilar materials, also included additional traumatic elements: microtunneling and tissue hypertension with hypercorrecting introduction of osteoplasts. In addition, local inflammatory reactions were purely local in nature and did not lead to the development of complications. At the same time, the treatment method used in the main group of patients was aimed at implementing the main task of the study - the formation of a bone regenerate capable of eliminating a limited defect of the alveolar process. The results obtained on the 14th day of observation indicated a complete subsiding of local inflammatory reactions. Against this background, the signs of bone regenerate formation, more pronounced in the main group, were visually and palpatory determined in the osteoplasty site. Here, complete elimination of the deformity after the first stage of treatment was achieved in 44.73% of patients (against 16.67%, with $p<0.05$-in the control).

Long-term treatment results were evaluated using clinical and radiological examinations. The results of X-ray monitoring of the effectiveness of injection methods for eliminating post-extraction deformities of the alveolar process were evaluated by indicators characterizing the formation of bone regenerate in the area of introduction of osteoplastic materials, the structure and volume of the newly formed bone, and the degree of its optical density. Our comparative study showed that with the combined use of osteoplasts (PRP and Collapan), radiological symptoms of an increase in the volume of the cortical bone (having a large-loop structure) appear already by the end of the first month after the completion of treatment. After 6 months of observation, this bone regenerate acquired a distinctive fine-loop structure. According to the results of the evaluation of the indicators characterizing the opti-

Table 1. Indicants of the optical density of the bone tissue of the alveolar part of the jaw in representatives of the comparison groups in the control periods of observations.

Follow-up period	Comparison groups	
	Main	Control
Before injecting osteoplasty	31 + 1.56% (n=68) p<0,05	
1 month (after osteoplasty)	40 + 1.67 % (n=38) p<0,05 p1 <0.05	37 + 1.56% (n=30) p<0.05 p1<0.05
3 months (after osteoplasty)	54 + 1.12 % * (n=35) p<0.05 p1<0.05 p2<0.05	41 + 1.38% (n=27) p<0,05 p1<0.05
"Normal" level	47 + 2.71% (n=68)	

cal density of bone tissue in the area of the performed osteoplastic therapy, it was possible to establish that the most dense and mineralized bone regenerate became after 3 and 6 months in the representatives of the main group. Moreover, here the indicators exceeded the normal level, which is due, in our opinion, to the combined (osteoinductive and osteoconductive) influence of the drugs used for treatment. In the control group, less pronounced results were obtained, inferior to the norm indicators, but significantly different from the initial values (Table 1).

Table 1. Indicants of the optical density of the bone tissue of the alveolar part of the jaw in representatives of the comparison groups in the control periods of observations

Notes:

n - the number of patients in the comparison groups;
p - the reliability of differences in comparison with the "normal" level;
p1 - the reliability of differences in comparison with the baseline level;
p2 - the reliability of differences in comparison with the control.

Thus, the results of our experimental and clinical study allowed us to establish that the injectable use of osteoplastic materials for local atrophy and deformation of the alveolar part of the jaw elimination leads to the activation of regenerative reactions and to the formation of bone regenerate. At the same time, the intensity of this process increases significantly with the combined use of drugs that have an osteoinductive and osteoconductive effect of local action.

Conclusion

The dynamics of the results of clinical examinations of patients in the comparison groups indicates that local inflammatory reactions developing in response to injectable subperiosteal injection of osteoplastic materials are moderately pronounced in representatives of both comparison groups and are completed by 5-7 days of observation. A more striking effect of bone growth is caused by the combined use of PRP and a synthetic drug (Collapan). The appearance of a section of newly formed dense tissue in the injection zone, according to visual-palpatory control, is determined on the 10th day of the post-injection period and is traced throughout the entire observation period (6 months). Combined injectable subperiosteal administration of osteoplastic materials contributes to a significant increase in the optical density (mineralization) of bone tissue in the zone of osteoplastic therapy (by 21%, at p<0.05), during three months, in comparison with the control (10.0%, at p<0.05), with the formation of a small-cell and more voluminous (than in the control) bone regenerate.

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