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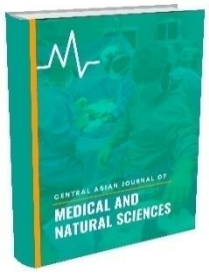

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# Clinical Estimate of the Efficacy of Osteoplastic Material Osteon Collagen 3 by Using Socket Preservation Method

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**Abstract:** After the extraction of a tooth in the alveolar ridge the mechanism of irreversible changes is triggered, in particular, the ridge itself in the area of the tooth socket begins to decrease in volume and morphologically transform. These changes subsequently create unfavorable conditions for prosthetics procedures in the extraction site and sometimes the impossibility of installing the implant (2, 3). Preventive measures on the part of the dental surgeon and in particular the manipulation of the tooth socket, which help to preserve its volume, help not only to carry out the implantation procedure in this place, but also to achieve an excellent aesthetic and functional result when prosthetic on the implant. Such measures can be applied thanks to the modern development of technological production of modern technologies for the creation of materials for guide bone regeneration (GBR). The possibility of using the none resorbed and the resorbed barrier membrans with only one substitute material Osteon Collagen 3 for preserving alveolar ridge after tooth removal was disclosing in this article.

**Key words:** alveolar bone tissue, osteoplastic material.

**Introduction.** One of the reasons for eliminating defects in the alveolar bone tissue and preserving its existing volume after tooth extraction is the need for subsequent restoration of the patient's masticatory efficiency. Any procedure involving the restoration or prevention of bone loss is performed using the method of directed bone regeneration (DBR). This method consists of the use of bone grafting material of auto-, xeno-, allogeneic or alloplastic origin. It also utilizes barrier materials that prevent soft tissue invagination into the defect with the graft. The barrier materials themselves are resorbable and non-resorbable membranes of different consistency, which are fixed in place using fixation elements (pins, screws, etc.). One of the most important factors when using the NCR method is the choice of the optimal material for fast and effective restoration of bone tissue defects. Of the materials available on the market, alloplastic material appears to be one promising material of choice.

If the patient decides to use the proposed implantation methods during tooth extraction surgery, the dental surgeon is faced with the question of whether to use either the immediate implantation method in the extraction well or the delayed implantation method. The method of introducing osteoplastic

material into the extraction site is used in cases when immediate implantation (immediate implantation) is impossible due to a number of reasons (impossibility of apical fixation of the implant, destroyed walls of the extraction site, proximity of anatomical structures, etc.). This paper presents the results of the comparison of studies with the new generation alloplastic material Osteon Collagen 3 (produced in South Korea) and alloplastic material Collapan L (produced in Russia) when filling the cavities of extracted teeth with them.

To date, the material of choice for this procedure in domestic dental surgeons and neighboring countries in most cases is the material Collapan L. We have conducted studies to compare both materials in order to identify their positive and negative characteristics.

According to the data of modern researches, as domestic scientists, and also scientists of near abroad and far abroad on studying of increase of efficiency of use of osteoplastic materials and membranes, process of regeneration of a tooth well still remains an acute problem, and together with it a number of questions demanding more careful their consideration in a spectrum of occurrence of new materials, development of new methods of treatment that in turn demands careful radiological, histological and other methods of research in this direction. The practical justification for the thesis is the performance of objective evaluation of the regeneration processes of the filled defects of the jaw alveolar outgrowth by the new osteoplastic material Osteon collagen 3 of alloplastic origin and the disclosure of effective techniques for the preservation of bone tissue volume after tooth extraction in order to create optimal conditions for further dental implantation.

**Purpose of the study:** clinical evaluation of the effectiveness of osteoplastic material osteon collagen 3 using the socket preservation method

**Materials and methods of research:** We studied 48 patients who came to the Dental clinic without and with destructive changes in the walls of dental cavities due to tooth extraction at the age of 30-65 years for the years 2020-2021 inclusive.

This research work is based on the application of experimental and clinical research methods.

All studies were conducted using registered and certified materials in the Republic of Uzbekistan. The studied material Osteon Collagen 3 produced in South Korea (№TBX 03042/2019,p.Uz) was subjected to experimental and clinical research in comparison with the similar alloplastic material Collapan L produced in Russia (№TT05005/2005,p.Uz).

To fill the bone tissue defects in experimental animals (rabbits) the alloplastic bone replacement material Osteon Collagen 3 manufactured in South Korea was prepared. Osteon Collagen 3 is a new synthetic material, the composition of which includes 60% of hydroxyappatite and 40% of calcium phosphate with collagen particle coating (Figure 1 ).


**Fig.1 Alloplastic bone replacement material Osteon collagen 3.**

**Material Characteristics:**

1. 100% synthetic material;
2. Porosity corresponds to the structure of human cancellous bone (80%);
3. Osteoconductive material, which stimulates the growth of bone beams;
4. Highly interconnected macro/microporous structure;
5. No potential risk of disease transmission;
6. Easy manipulation;
7. Excellent wettability (hydrophilicity);
8. Presence of xenogenic coating: porcine or bovine collagen;
9. Collagen coating facilitates the grip of the material, reducing the total operation time;
10. Once moistened, it becomes plastic, allowing it to be easily distributed over the defect area;
11. Once the fragment is placed in the cavity, the collagen sheath dissolves;
12. Excellent properties of forming new bone and filling bone defects;
13. Promotes hemostasis;Размер зерна**:** 0.5-1.0мм

Packaging: Cylinder: Ø6mm x 10mm

Volume: 0.28cc

The material has high regenerative and osteoconductive properties. It is used in all directions of NKR.

Collapan - the preparation replaces damaged bone areas, counteracts infectious phenomena for up to twenty days with a uniform antibiotic effect (see Figure 2).

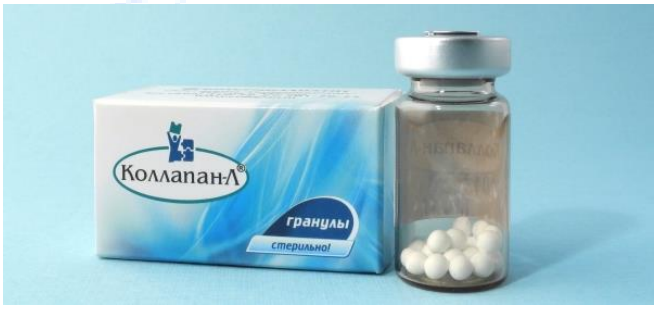


**Fig.2.Alloplastic bone replacement material Collapan L.**

**Composition of the drug:**

1. synthetic hydroxyapatite;
2. collagen compounds;
3. active elements (lincomycin hydrochloride salts, gentamicin compounds, metronidazole, etc.).

Depending on the active element, subtypes of the drug are distinguished, which is reflected in the lettering in the name. For example, the composition of Collapan-L includes hydrochloride salts of lincomycin. When using this or that subtype, you need to pay special attention to the active substance, since its choice depends on the speed of healing and antibiotic effect, as well as the risk of allergic reactions. The use of antibiotics of different types and modes of action in the drug makes it possible to so select the composition to most effectively fight a particular infection and successfully suppress it.

Characteristics of the material: the drug is a fine powdery composition of hydroxyapatite elements embedded in a collagen base with the addition of an antibiotic. Collagen has unique properties. Due to its structure, it is non-toxic, non-carcinogenic, almost does not cause allergic reactions, is fully processed by the body, binds well with the active substances of drugs and triggers repair processes in damaged areas. The action of the drug is based on the fact that the active substances penetrate into the damaged areas not immediately, but during the entire time of its action. This makes it possible to gradually restore bone tissue through the formation of calcium and phosphorus ions, which are introduced into the composition of the restored bone formations and accelerate healing. Substances included in Collapan become the basis for the growth of the regenerated areas. Dissolving, they create growth points on themselves, where active biological elements are deposited. This process allows the prototype of the solid fragments being created to be formed by accumulating minerals. The buildup occurs directly on the drug molecules. The emerging cartilage base then hardens and becomes mature bone. At the same time, the features of the drug avoid complications, there is practically no intolerance, which makes it possible to restore significant areas of damaged bones in a relatively short time. Antimicrobial properties in combination with the gradual release of the active substance give reliable protection against inflammation during the entire period of treatment. The antibiotic treatment performed reduces the risk of further development of infectious processes. Thus, Collapan, thanks to a comprehensive approach, allows you to have an effective effect on damaged areas, returning them to health and strength.

Collapan is widely used in all areas related to the surgical treatment of bones, such as traumatology and orthopedics, neurosurgical procedures and surgical interventions for the treatment of the spine, the elimination of suppuration and in the field of military surgery. It is used to fill the damaged areas and antimicrobial treatment is carried out. For the treatment of a particular infectious lesion, it is possible to select a specific antibiotic, which is included in the composition of the drug as an active ingredient. This allows for a more effective therapy.

Two types of South Korean-made membranes were used as barrier materials: absorbable and non-absorbable membranes

BIO-MEM dense polytetrafluoroethylene membrane (pPTFE) was chosen as the non-absorbable membrane (see Figure 3).

**Fig.3 pPTFE membrane Bio-MEM)**

Colla-D collagen membrane with a resorption period of 6 months (Figure 4).

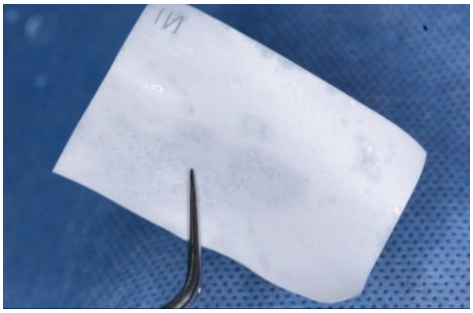


**Fig.4 Colla-D resorbable collagen membrane (Bio-MEM)**

We used pPTFE membrane to reconstruct Elian et al. grade 3 defects due to its certain stiffness and ability to hold the shape of the graft. This helped us to reconstruct the lost dental cavity walls with the membrane itself. Whereas in case of minor defects of the cavity walls (fenestration, dehistence), which was observed in grade 2, we used collagen resorbable membrane (Table 1).

**Table 1. Distribution of patients in both groups depending on the type of defect in the classification according to Elian et al. and the type of membranes used**

| Diagnosis | 1 type (according to Elian et al.) (n=48) | 2 type (по Elian et al.) (n=48) | 3 type (по Elian et al.) (n=48) |
|---|---|---|---|
| Patients | 24 (50%) | 9 (18,8%) | 15 (31,2%) |
| Membrane material | Polytetrafluoroethylene -lene /Collagen | Collagen | Polytetrafluoroethylene |
| Membrane type | Dense/Elastic | Elastic | Dense |
| Membrane resorbability | -/+ | + | - |

Microscrews for osteoplasty from the SurgiDent kit were used as fixation elements for barrier membranes

All materials were stored in a household refrigerator at 4-6 degrees Celsius before use.

There are various methods to preserve bone volume or to minimize bone loss after tooth extraction. The types of procedures can be summarized as follows [63,p.809-818]:

1. Preservation of endodontically treated tooth roots.

2. NCR.

3. Immediate-implantation.

4. Use of analogs of tooth roots.

One of the main alternatives in the application of methods to preserve the volume of the surgical alveolar process is the procedure of immediate implantation after tooth extraction - Immediat implantation [18,p.28-30]. However, this method of treatment is often not possible for the following reasons:

1) unfavorable orientation of the tooth axis along which the implant is planned to be placed, which may lead to fenestration of the cheek wall of the well and the occurrence of overimplantitis (see Figure 2.1.5, Fig.

Results: In this work, we aimed to use exclusively one osteoplastic material in various dental well defects according to the classification of Elian et all. In our work we used a new South Korean alloplastic material with a wide range of possibilities - Osteon Collagen 3 (South Korea). There is little

scientific data on the use of this material in the technique of NCR, and, in particular, we have not found any data on the preservation of the well, so the purpose of our research was to study the properties of this material within the framework of this technique, as well as to obtain additional information about this material when it is used in selective (random) clinical situations in the treatment of bone tissue defects of the jaws (apicectomies, sinus elevator). Since at the moment the Russian-made alloplastic material Kollapan L is widely used in our country for the procedure of cavity preservation and filling of jaw bone defects, we in our turn decided to use this material in a comparative category in our research. As a baseline for the histologic study, we performed an experiment where we created a 5-wall defect in the tibia of rabbits mimicking the defect of the well of an extracted tooth. The procedure was performed using Osteon Collagen 3 and Colla-D resorbable collagen membrane. The data of histologic analysis showed that the optimal regenerative potential of this material was found at the period of 12 months of the experiment, but at the period of 9 months a positive result of bone defect regeneration was also observed. Based on these data, we decided to take biopsy specimens of 12-month regenerates for histologic examination in clinical trials.

In the course of the obtained results of the study we found out that when using exclusively one alloplastic material Osteon collagen 3 during the preservation of the wells of 24 patients in the study group, we obtained a restored volume of the alveolar ridge, which can be used for implant treatment. The data of the radiologic picture showed the preservation of the alveolar bone volume in the cheek-tongue direction with a small degree of resorption on average 0.4 mm, which practically does not affect the planning and selection of implant sizes. The measurement of the alveolar ridge height on the safe segment C-D also showed no signs of the ridge height reduction, and in some cases its slight increase, but by the amount also not influencing the choice of the implant size. The radiological picture with the use of Osteon collagen 3 showed the homogeneity of the bone tissue structure in the augmentation area and radiopacity of the material itself, and therefore this is its positive property for the purpose of determining the localization of the material in the wells, its volume before and after augmentation, as well as planning the implant apex location in case the doctor wants to fix the implant in the native bone. When measuring the change of bone density according to Mish, we found the same pattern of formation of 3 types of bone density in the wells of teeth. When analyzing the above-mentioned results with the histological data, we can say that this pattern is explained by the presence of vessel-rich osteogenic fibrous tissue in the area of the augmentation. Granules of unresorbed hydroxyappatite are found in some places during biopsy extraction, which is natural when synthetic materials are used as bone substitutes. In the case of Collapan L material, we could not detect traces of this osteoplastic material due to its neurogenocontrast and high degree of resorbability, but the possibility of measuring the volume of the alveolar ridge at the implantation site before and after augmentation showed that the material has low osteoconductive properties, namely: there was atrophy of the alveolar process along the width of the ridge by an average of 1. 7 mm, which in itself posed a significant problem for implant placement. 7 mm, which in itself posed a significant problem for implant placement. At the same time, measurement of the vertical dimension showed no significant change towards a deficit compared to baseline. In the area of the augmentation no bioimplant residues were detected during biopsy sampling, moreover, the density itself did not differ from the density of the adjacent area of native bone, which testified to the low osteoconductive properties of the material, but to its high regenerative potential. Thus, Osteon collagen 3 material compared to Collapan L material has high osteoconductive properties.

**Conclusions:** Thus after the main studies of the method of preservation of dental cavities in patients, a number of selective clinical studies were carried out by apicectomy and sinus elevator methods. These methods were chosen on the basis that they create approximate 3- and 4-wall defects with a similar pattern of blood supply of the graft as in cases of defects with wells.

Collagen-type barrier membranes have been used in sinus elevator surgeries. The peculiarity of this type of surgery was the one-stage implantation and grafting of osteoplastic material into the sinus. The data of radiologic analysis showed the stability of the graft volume both before and after augmentation. The histologic sample analysis revealed a similar histomorphologic tissue pattern as the samples taken from the patients in the study group.

The apicectomy procedure also revealed the presence of indicators of matured augmentation on the radiographic and morphologic examination side.

When considering the histologic results, it was revealed that the material Osteon Collagen 3 had the most pronounced regenerative processes of bone fragments at the site of osteon grafting at later dates: 9-12 months. The morphological picture of the bone tissue after Collapan L application is characterized by enhanced osteointegration, signs of regeneration by the abundance of osteocytes and angiomatosis.

All this allows us to say that both materials can be successfully used in the method of preservation of dental cavities, but to obtain and preserve the volume of the cavity for the purpose of subsequent implantation, we recommend the use of Osteon Collagen 3 as a material with good osteoconductive and regenerative properties..

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