



# Implant-Prosthetic Rehabilitation of Patients with Orthopedic Structures & Extreme Atrophy of the Upper Jaw During Prosthetics on Zygomatic and Angular Implants

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## Abstract

Complex maxillofacial pathology is characterized by pronounced violations of the maxillary structure and abnormal disfigurement of the patient's face. Implant-prosthetic rehabilitation of patients is quite popular in modern reality. It is not so much about the aesthetic side of the issue, as about the physiological necessity. Extensive defects of the dentition after surgical interventions, which are most often accompanied by atrophy of the jaw tissues, inflammatory processes, neoplasms, etc. jaws require a special comprehensive approach to the rehabilitation of patients with orthopedic structures. Zygomatic implants are a rehabilitation option for patients with extreme bone atrophy in the upper jaw. The purpose of this scientific work is to analyze scientific publications describing cases of implant-prosthetic rehabilitation of patients with orthopedic structures with extreme atrophy of the upper jaw during prosthetics on zygomatic and angular implants.

**Discipline:** Medicine, Dentistry, Orthodontics, Surgery

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## 1 Introduction

Traditional removable dentures cannot always eliminate defects associated with extreme loss of jaw tissue, extensive loss of dentition. Restoration of speech, swallowing effects is possible almost in full, but chewing functions will cause the patient difficulty [1,2]. Moreover, such difficulties occur not only during the rehabilitation period, but also after the complete completion of treatment [3,4]. Most often, traditional dental implants are used, which perform the function of stabilizing the prosthesis, maintaining its resistance to horizontal loads during chewing. Cases, when such prostheses are insufficient, are associated with extreme tissue loss during surgical intervention, resection of extensive areas of bone tissue [5].

Zygomatic and angular prostheses are used to restore the upper jaw, the method consists in installing the implant at a special angle, which is determined by the presence of bone tissue, excluding bone block transplantation and lateralization of the nervus mandibularis [6-8].

## 2 Literary review

The installation of prostheses on zygomatic and angular implants proved to be effective. Complications and risks for the patient are minimized, provided that all the recommendations of the specialist are followed. Inflammatory processes, fistulas, ulceration of tissue occur only through the fault of the patient himself [9-11].

Delayed prosthetics after tooth extraction leads to a number of structural changes in the bone tissue: bone density decreases, the spongy layer begins to decrease, atrophy, osteopenia occurs, and then osteoporosis of the jaw [12]. These phenomena do not always depend on the use of prostheses, genetic predisposition and other factors affecting the patient's health also affect here.

The advantages of zygomatic implants are the recovery time and economic feasibility. Such implants are much cheaper than bone grafting, they allow you to combine implantation and resection of tissues to be removed in one operation [13].

Patients with traumatic lesions of the maxillofacial region, age-related patients, oncopatients have problems with fixing prosthetic structures, both removable and non-removable [14].

To solve this problem, protocols of transculular, angular implantation and intraoperative prosthetics are used [15].

Modern orthopedic planning of the protocol of operations makes it possible to abandon, among other things, the use of angular abutments, which leads not only to simplification and cheaper construction but also to increase its reliability. Implants with the possibility of intercortical and polycortical fixation are also used to achieve the tasks set [16-18]. Due to the fact that transculary implantation protocols are performed, as a rule, in the practice of maxillofacial surgeons, this technology, unfortunately, is limited in outpatient dental practice [7,14,19].

## 3 Method

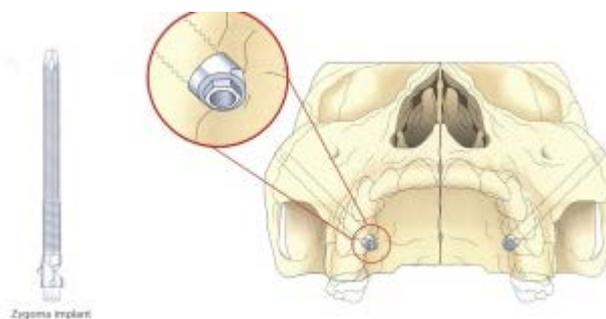
The main direction in angular implantology is the rehabilitation of the upper jaw using implants of various types in combination with angular implants.

Information about the technology of installing zygomatic and angular implants has been available since 1989 and is actively developing in many countries. In the Russian periodical scientific press, information about the use of implant-prosthetic technology for zygomatic and angular implants has been found since 2006. The effectiveness and complexity of this protocol and the impossibility of using such a technique in outpatient settings are noted.

Observations of more than 3,000 patients were carried out in 11 private and public clinics of the Russian Federation. The age of the patients ranged from 13-92 years. Indications for prosthetics in 80 percent of cases – bone atrophy, two-tenths of a percent accounted for oncological diseases, the remaining cases are associated with injuries.

Prosthetics on zygomatic implants can improve the quality of life of patients with complex cases. Zygomatic and angular implants exclude the use of bone grafting with a long period of tissue stabilization for subsequent implantation of implants and installation of prostheses on implants [20].

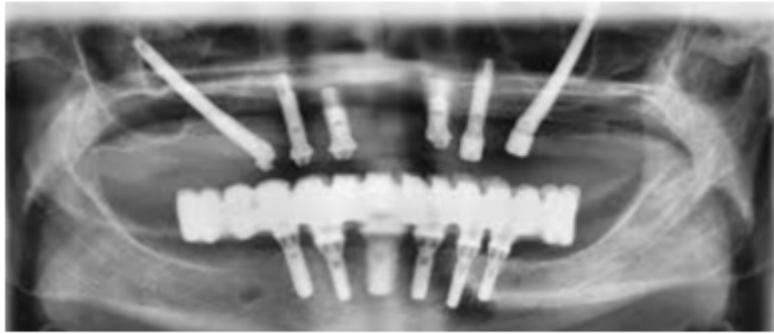
Rods of 30-60 mm in size are screwed into the subglacial (zygomatic) bone tissue, which is little susceptible to destructive changes [21]. Today, two types of systems are used: straight and beveled platforms [22]. The edge of the beveled rod is installed parallel to the gum, which does not require the use of additional structures, therefore, the maximum simplification of the fixation of the orthoprosthetic system occurs. Rods differ in their properties depending on the manufacturer. Some have a smooth structure and antibacterial coating, while others, on the contrary, are porous and have micro-sections [23-25]. The choice of a rod for implantation into the bones of the upper jaw depends on the protocol of orthodontic treatment and indications for use (Figure 1).



**Figure 1:** Installation of a titanium rod in the zygomatic bone

Implantation of the rod into the bone zygomatic tissue is not a special protocol of dental prosthetics. There are three ways to use this technique in the complete absence of the dentition of the upper jaw [26]:

- install 4 roots – 2 front and 2 sides;
- install 6 roots, all can be zygomatic (figure 2);
- install 8-14 roots at an angle in the lateral sections.



**Figure 2:** X-ray image with the demonstration of implanted zygomatic implants (6 roots)

Figure 3 schematically shows some options for implanting titanium rods into the zygomatic tissue and bone tissue of the upper jaw.



**Figure 3:** Options for implanting implants in the bone tissue of the upper jaw

This technique is applicable for extreme atrophy of the upper jaw, it does not require bone grafting and a long period of rehabilitation with loss of aesthetic appearance of the patient. A prosthesis can be installed on zygomatic implants immediately, or 3-4 days after implantation. Such implants can participate in the restoration of the masticatory group of the dentition [27].

The installation of prostheses immediately after surgery eliminates the loosening of the implants, they can serve the patient until the end of his life. It only requires the replacement of the orthopedic systems themselves as they wear out.

Indications for the installation of zygomatic and angular implants are:

- complete or partial loss of upper jaw teeth;
- extreme atrophy of the upper jaw due to resection of degenerative tissues;
- periodontal disease (advanced stage);
- periodontitis (advanced stage);
- osteopenia;
- osteoporosis;
- oncological diseases followed by radiation therapy.

This methodology is characterized by the following positive characteristics, which make it attractive in maxillofacial surgery:

- accelerated treatment protocol – from implantation to prosthetics takes from one to seven days;
- there are practically no contraindications;

- applicable even in cases of extreme maxillary atrophy: absence of the alveolar ridge, complete or partial absence of the maxillary bone due to cancer or injury;
- no bone buildup is required, titanium roots are implanted into the dense zygomatic bone at a certain angle;
- a prosthesis is immediately installed, which looks like a natural dentition (Figure 4);
- the materials from which the prosthesis is made (metal-plastic or ceramic composite) do not create excessive load on the implants during physiological movements of the jaw, including chewing;
- reliable fixation of implants in the zygomatic bone;
- a high probability of survival due to the absence of inflammatory processes in the zygomatic bone;
- durability of titanium implants.



**Figure 4:** Orthodontic prosthesis installed on zygomatic and angular implants

Nevertheless, as mentioned above, this technique is practically not applicable in outpatient settings [28]. Such orthodontic treatment can only be performed in a hospital by a maxillofacial surgeon.

The preparatory and operational period includes a number of stages [29]:

- a complete examination of the patient for contraindications to surgery;
- computed tomography of the jaw;
- 3D modeling of a copy of the jaw;
- using a 3D printer to print out a full-size jaw as a stand for an upcoming operation;
- installation of dummy rods in a 3D model for precise positioning of implants in the zygomatic bone of the patient;
- the installation of zygomatic implants takes place at an angle of 30-60 °, which requires jewelry precision in the area of the nasal sinuses in order to avoid injury to them;

- simultaneous installation of a prosthesis with a metal beam that stabilizes the pressure on the implants during chewing is possible;
- the operation is performed under general anesthesia.

The use of angular implants reduces the time of dental rehabilitation of patients, minimizes injuries from surgical intervention, tissue regeneration occurs much faster, and the implantability of such implants is ninety-eight percent. The quality of regeneration also depends on the patient and their compliance with hygienic standards of oral care. It is necessary to pay attention to patients with loss of motor functions of the limbs who cannot take care of the oral cavity on their own, the exclusion of complications in the postoperative period depends on this [30,31].

## 4 Result and Discussion

Studies in the field of the installation of zygomatic implants, which are published and available to the scientific community, are almost unambiguous in their conclusions: this technique is effective, and gives an opportunity for a high-quality life to patients with neglected or hopeless cases of upper jaw deformity.

The use of angular, trans-musculoskeletal and polycortical implants, both according to the original protocol and in a combination of protocols, reduces the time of dental and maxillofacial rehabilitation and reduces the traumatism of operations. The possibility of installing temporary screw prostheses in the oral cavity is realized – direct intraoperative prosthetics within 0 – 72 hours after surgery.

## 5 Conclusion

Thus, the protocols of angular, trans-musculoskeletal and polycortical implantation expand the possibilities of dental and maxillofacial rehabilitation and are one of the most actively developing areas in pre-prosthetic reconstructive surgery. Modern orthopedic planning of such an operation protocol makes it possible to abandon the use of cement fixation and angular abutments, which leads not only to simplification and cheaper construction but also to an increase in its reliability. To master the protocols of transculular, angular and polycortical implantation, training of specialists is required within the framework of a new platform of interdisciplinary cooperation, that is, the formation of practical skills in a team of specialists.

Implantation of artificial roots into the zygomatic bone practically leveled the statistics of hopeless dental cases, improving the quality of life of patients with extreme maxillary atrophy. This type of surgery is impossible without the participation of a maxillofacial surgeon and an anesthesiologist, the type of clinical research assumes the presence of high-tech modern equipment in the clinic. The cost of zygomatic implants is quite high, but the material from which they are made, and the method of their implantation, guarantees their lifelong use with periodic replacement of the external dental prosthesis as it wears out.

## 6 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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