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# ENDOPROSTHESIS OF THE MANDIBLE WITH EMBEDDED DENTAL IMPLANTS. A CLINICAL CASE

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**Abstract:**

*Reconstruction of the mandible after partial or complete resection is a prerequisite for the restoration of normal facial aesthetics, articulation and chewing function. This publication presents a clinical case of recovery of the patient with acquired extensive defects while taking drugs based on pervitin and desomorphine. Specially manufactured individual endoprosthesis with embedded dental implants was used to restore the manbible and to fix the denture. Proper dental rehabilitation means a lot for endoprosthesis survival as chewimg function can lead to thinning of the oral mucosa and further eruption of the endoprosthesis. Moreover, improper loading can lead to problems with temporomandibular joints. The use of individual endoprosthesis with embedded dental implants helps to restore proper dental function and can lead to better quality of life and higher endoprosthesis's survival rates.*

***Key words:*** *mandibular reconstruction, endoprosthesis, dental implants*

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**INTRODUCTION:**

The mandible is the only movable and most massive bone of the facial skull, which is the support and place of attachment of functionally important muscle groups. It plays one of the main roles in ensuring the functions of chewing, swallowing, articulation and, in some cases, breathing.

Extensive mandibular defects lead to asymmetry of the lower face zone, cause functional impairments, and are also accompanied by a loss of the person's aesthetic appearance [1]. Fixation of the jawbone fragments with a standard titanium plate and subsequent removable prosthetics should be considered a relatively satisfactory solution. The development and implementation of more durable and physiological constructions is required. Currently, the development of CAD / CAM technologies allows the manufacture of individual implants for cranio-maxillofacial prosthetics.

We present a clinical observation, which presents the stages of planning and carrying out surgery, describes the method of manufacturing an individual endoprosthesis of the mandible as well as the features of the patient's preoperative preparation.

**The clinical case**

Patient A, born in 1985, History: drug abuser based on desomorphine and pervitin. Remission 6 years. In 2004, she was operated on in the city of Ukhta, a sequestrnecrectomy was performed. In 2006, a second sequestrnecrectomy was performed, tooth extraction 43, 44. In 2009, a serial production reconstructive plate "Konmet" was installed in Ukhta. She applied to the maxillofacial surgery clinic of the First Moscow State Medical University in 2012 with complaints of exposure of the endoprosthesis in the oral cavity, violation of chewing and eating, deformity of the face. (Figure1).


**Fig. 1 A- A look of the patient when applying to the clinic of maxillofacial surgery of the Sechenov First MSMU; b - orthopantomogram, condition after resection of the mandible and fixation the reconstructive plate of mass production**

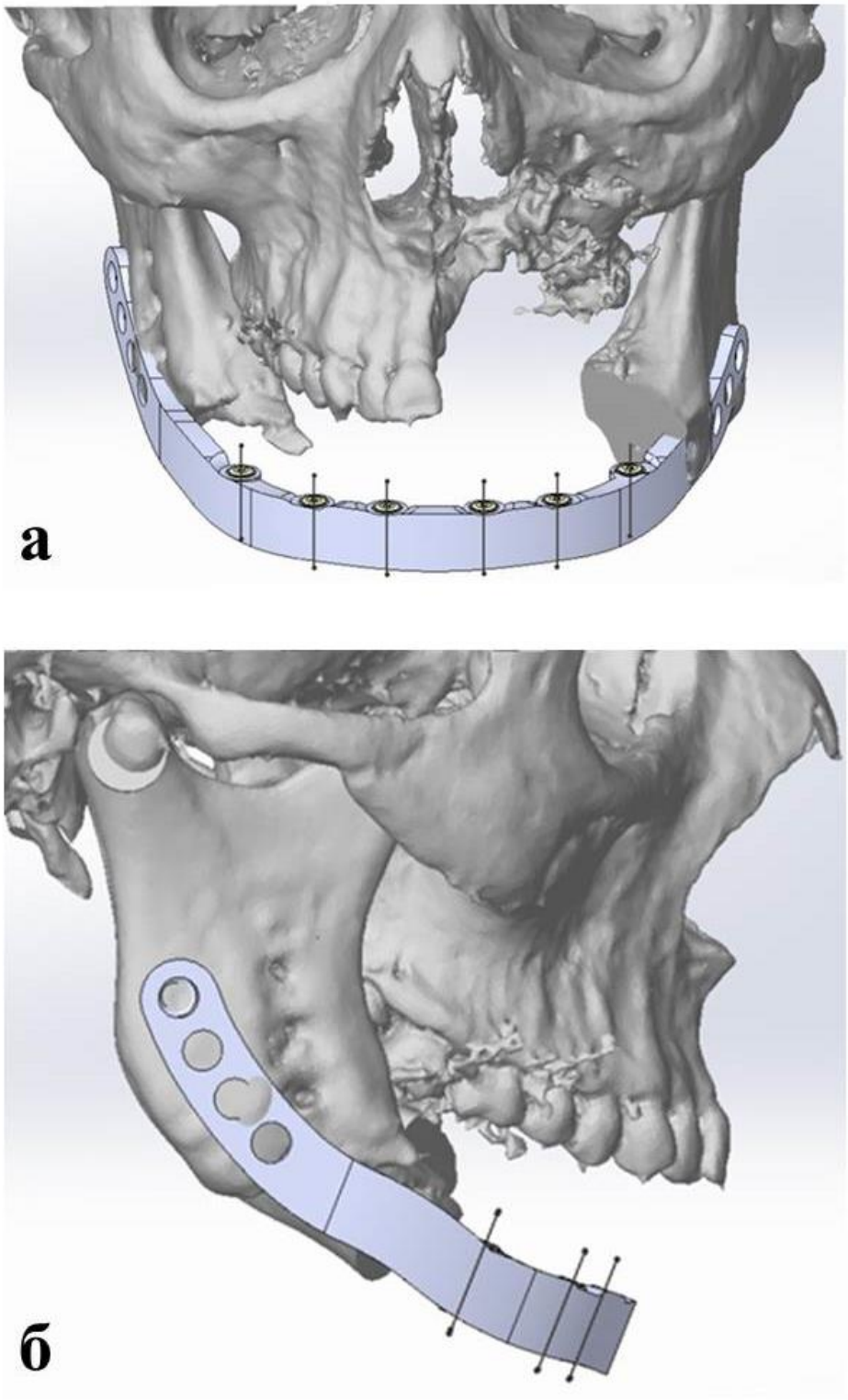


**Fig. 2 Analysis of the virtual model of the visceral cranium. Modeling an individual endoprosthesis of the mandible.**


**Fig. 3 Planning the stages of the operation. Fitting an individual endoprosthesis with supporting zones for dental implants on a stereo model.**

At the council, a decision was made to manufacture an individual endoprosthesis with the inclusion of dental implants for subsequent prosthetic restoration. The first stage was the removal of the erupted titanium structure, relief of inflammation. After 5 months individual endoprosthesis was set.

Preoperative planning. The patient underwent a spiral computed tomography of the skull with volumetric reconstruction of the image, on which a total bone defect of the mandible body and a defect of the left maxillary bone with complete edentulousness in the second segment are determined (Fig. 2). Stereolithographic models were made using MSCT (Fig. 3).

A team of authors, together with engineers from «Conmet», has developed an individual titanium endoprosthesis with shafts for implants [2]. The implants were fixed in the endoprosthesis body at the factory.

Operation progress. A standard submandibular incision was made on the right and left, a preauricular

incision using the Bramley-Al-Kayat technique [3]. In the area of the preserved body of the mandible, on the right and on the left, an osteotomy of the cortical layer was performed, a groove 2 mm wide was formed for laying the anterior part of the endoprosthesis fragment. The endoprosthesis was installed and fixed with screws in the area of the bodies of the articular processes on the right and left. The wound was sutured in layers, drainage was left for 2 days. In the complex treatment of the patient, standard antibacterial, anti-inflammatory, symptomatic therapy was carried out. The early postoperative period was unremarkable. Healing of wounds by primary intention, without complications. After 6 months, an impression was taken using transfers. Prosthetics was performed with the manufacture of a conditionally removable prosthesis of a bar construction on individual abutments. The cosmetic and functional result was assessed as satisfactory. The shape and size of the lower jaw, facial contours have been restored, the range of active movements of the lower jaw has increased. The positive result lasts for 6 years after the operation.

**Fig. 4. Oral cavity examining, 7 years after the surgery.**

Recently, a large number of scientific works have dealt with the correspondence of the hysteresis behavior of the endoprosthesis system to the hysteresis behavior of tissues. Many works are devoted to the advantages of manufacturing individual endoprostheses [4]. Nevertheless, it is unlikely to achieve a lasting functionally and aesthetically satisfactory result after arthroplasty of extensive defects of the lower jaw in the absence of dental prosthetics.

**DISCUSSION:**

Currently, the most frequent reconstructive operations in the maxillofacial region in patients with the above pathology are performed using allografts, revascularized and nonvascularized autografts, endoprostheses. Based on the analysis of the properties of the above groups of grafts (Table 1), it can be concluded that endoprosthetics is one of the most promising areas of reconstructive surgery in the maxillary region.

| Type of reconstruction | Pros | Cons |
|---|---|---|
| Allograft | Does not require the creation of an additional operating field; there is a possibility of replacing combined defects of the face and jaws; the possibility of transplantation in patients with cancer in remission (more than five years) and in HIV-positive patients [5]. | The need to create a bone bank [6], technological complexity, differences in the size and geometry of the donor site and the defect [7], the possibility of infection of the recipient cannot be ruled out; approval from the ethics committee is required. |
| Non-vascularised autograft | A less technically complex and costly operation compared to the use of a vascularized graft, there are more sites for collection; reducing the risk of graft rejection. | Donor site trauma; limited available volume for the intake [8]; resorption [9,10]; it is not always possible to make up for an extended defect [7]; risk of infection [11]. |
| Vascular autograft | Possibility of replacing extended jaw defects (up to 8 cm); used after radiation therapy and in soft tissues with cicatricial changes; the possibility of implantation (there are both positive and negative results) [11,12]; preventing the risk of graft rejection. | Injury of the donor site, expensive equipment and high qualification of the surgeon are required, it is not always possible to fill the defect; long operation time; the need for two specialized surgical teams; morbidity; longer hospital stay [13-16]. |
| Endoprosthesis | Does not require the creation of an additional operating field; the ability to manufacture an individual endoprosthesis with pre-calculated optimal geometric parameters, which can significantly reduce the operating time; the possibility of prosthetics when using an endoprosthesis with embedded implants. | Fracture of the fixing part of the endoprosthesis, intrusion of its head into the cavity of the middle cranial fossa during arthroplasty; eruption [17]; risk of infection; the thickness of the endoprosthesis, which does not provide a sufficient amount of reconstruction [11]; fatigue of the material, which imposes restrictions on the duration of its service. |

**Table 1. Pros and cons of various reconstructive materials.**

Most authors positively assess the experience of using endoprostheses of the mandible, emphasizing its prospects [18]. It should be noted that the use of the temporal bone glenoid fossa prosthesis prevents the recurrence of ankylosis and the penetration of the articular head of the endoprosthesis into the cavity of the middle cranial fossa [19].

Historically, for endoprosthetics of the mandibular and temporomandibular joint (TMJ), alloys that are resistant to corrosion in body fluids have been used: stainless steel, an alloy of cobalt (vitalium), chromium, molybdenum, and tantalum [20]. The most popular were endoprostheses of the mandibular branch from vitalium, proposed by B.S. Freeman (1948) [21]. In subsequent years, materials from titanium and its alloys were actively introduced into medical practice. In particular, R.W. Christensen (2004) developed numerous variants of titanium prostheses, described the methods of surgical interventions for prosthetics of the glenoid cavity and the branch of the mandible [4].

Positive properties of titanium and its alloys: high biocompatibility; bioinertness in body tissues; corrosion resistance due to the formation of an oxide film that is stable in the environment of the body; modulus of elasticity, close to the modulus of elasticity of the bone; good corrosion resistance; non-magnetic; low thermal conductivity; low coefficient of linear expansion; no clinically significant toxicity [22]. In addition, experimental studies on animals have shown that titanium structures are more resistant to fatigue loading compared to other materials [4]. Nevertheless, the development and introduction into clinical practice of more advanced material does not exclude the development of both early and late complications, which can be associated, among other reasons, with the insufficient physiological nature of the replacement construct.

One of the important anatomical features of the jaws is the presence of teeth that perform a number of important functions, which imposes a certain specificity not only on the course of diseases of the maxillofacial region, but also on the approaches to their treatment and rehabilitation [23, 24]. The loss of a fragment of the lower jaw with the loss of the chewing function on the affected side leads to uneven work of the group of masticatory muscles with the development of secondary asymmetry of the face. In addition, additional trauma to the mucous membrane in the absence of dental prosthetics leads to the eruption of the endoprosthesis. Also, the absence of antagonist teeth in the opposite segment leads to a decrease in their functional load, the development of the Popov-Godon phenomenon [25], periodontal ligament diseases and early loss of intact teeth. The absence of teeth leads to pathology of the temporomandibular joint (TMJ), which is one of the important organs involved in postural control of the human body [26].

The most optimal method of rehabilitation for patients with partial and complete edentulousness is dental implantation [27]. Nevertheless, for obvious reasons, this method of restoration of the dentition is practically impracticable during a standard metal endoprosthesis [28]. Thus, it is promising to manufacture and use an individual endoprosthesis of the mandible with embedded implants. After tissue regeneration around the endoprosthesis, prosthetics on implants installed in ready-made shafts using individual abutments is possible. Based on the anatomical, physiological and aesthetic significance of the mandible, we can claim that implantation is important for the restoration of vital functions and maintaining an acceptable standard of life quality for the patient [29, 30].

## CONCLUSION:

Thus, due to the proposed method of endoprosthetics, it is possible to solve the main tasks of reconstructive surgery: to restore the functions of the mandible and also to recreate the aesthetics of the face as closely as possible, which in turn has a significant effect on the patient's quality of life. This clinical case clearly demonstrates that the reconstruction of the jaw with a titanium endoprosthesis with the further manufacture of a conditionally removable dental prosthesis makes it possible to obtain a predictable stable result in the long term.

Conflict of interests

The authors declare no conflicts of interest.

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