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APPLICATION OF INDIVIDUAL IMPLANTS IN THE ORBITAL FLOOR RECONSTRUCTION

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Abstract

Traumatic damages of midface zone represent one of the most difficult problems of emergency maxillofacial surgery. Hypodiagnostics and absence of treatment can be a reason of bone deformations, emergence of permanent esthetic and functional problems. In this article we present the experience of treatment of patients with orbital floor fractures with the superelastic titanium nikelide mesh.

Titanium nikelide mesh consists of porous fibers 60-80 nanometers in diameters. A total of 60 patients was treated by orbital floor reconstruction. Among those patients 48 had zygoma fractures, 6 – maxillary fractures and 6 – "blow out" fractures. All the patients were treated with a standard protocol – if the orbital floor fracture was diagnosed on CT the subcilliary incision was done and the reconstruction was performed using titanium nikelid mesh. This material was created in defect size during surgical intervention and then overlapping the defect to reduce further removal, delicately inserted and does not need to anchored.

On the postoperative CT the implant was in a good position in all cases. Clinical evaluation showed no complication due to infection, implant migration or functional disorder of visual organ over the period from 3 months to 3 years follow up. The use of titanium nikelid tissue for orbital floor reconstruction has been shown to be safe and effective. The accurate anatomical reproduction of orbital floor contours is achieved due to superelasticity of titanium nikelid. This generally leads to reduced operation time, and improve in functional and esthetic outcomes in orbital floor fractures. This material can be used in orbital floor reconstruction with good result.

Keywords: *orbital trauma, individual implant, orbital floor, fracture*

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INTRODUCTION:

Traumatic injuries of the bones of the middle zone of the facial skeleton represent one of the most difficult problems of emergency maxillofacial surgery. The percentage of traumatic injuries of the maxillofacial region around the world remains at a constantly high level. According to different authors, from 6 to 23% in the structure of injury according to the localization of damage belongs to the middle zone [1]. This process can be associated with the development of cities, increasing the level of technical equipment of society and production.

Modern tactics of surgical treatment of this pathology provides for an exact reconstruction, stable fixation and, if possible, restoration of all damaged structures [2]. Careful attention is paid to the reconstruction of the lower wall of the orbit [3]. Performing radiography in standard projections does not allow to identify this pathology [4]. Hypodiagnostics and the lack of treatment associated with it contribute to the formation of bone deformities with the occurrence of persistent aesthetic and functional impairments in this category of patients, such as impaired facial configuration, restriction of eyeball mobility, binocular diplopia, and development of hypo- and enophthalmos. Fractures of the facial skeleton, including damage to the walls of the orbit, are an extremely important section in the traumatology of the maxillofacial area and require attention from both maxillofacial surgeons and ophthalmologists, otorhinolaryngologists and neurosurgeons [5].

In order to achieve good results and the most complete social rehabilitation of patients in this category, it is necessary to develop a generally accepted diagnostic tactic and surgical treatment algorithm. At the moment, there is no consensus among maxillofacial surgeons about the extent of surgical intervention, materials for fixing bone fragments and eliminating defects of the orbital walls [6]. Drawing up an individual plan for each surgical intervention allows you to count on a favorable result and a decrease in the number of complications in the postoperative period.

MATERIALS AND METHODS:

60 patients with various traumatic injuries of the bones of the middle zone of the facial skull, accompanied by fractures of the lower wall of the orbit, were examined and treated. The patients' age ranged from 18 to 64 years, among them 54 men, women - 6. Among the patients, people of working age from 20 to 40 years predominate.

All patients were divided into three groups. The 1st group included patients with fractures of the zygomaticoorbital complex (48 observations). The 2nd group included patients with midfacial fractures of the type Le For II and III (6 observations). In the 3rd, patients with a fracture of the lower wall of the orbit according to the "blow-out" type (6 observations).

Clinical research methods

Examination of patients with traumatic fractures of the lower wall of the orbit began with a detailed collection of complaints, clarification of the history of life and disease, with the mechanism of injury, the period that passed after its receipt.

The time interval from the moment of injury to hospitalization in the hospital ranged from several hours to 10 days, the average period was 2.9 ± 1.6 days.

On admission, the general and local condition of patients was assessed, an external examination, an oral cavity examination, palpation of the tissues of the maxillofacial area, x-rays of the bones of the facial skeleton, and computer tomography of the midface and brain were performed.

All patients were examined in the amount of generally accepted preoperative preparation, including electrocardiography, chest x-ray, complete blood count, urinalysis, blood biochemistry, coagulogram, blood group and rhesus factor, detection of infections such as HIV, syphilis, hepatitis B and WITH.

X-ray methods of research.

To clarify the diagnosis and determine the extent of surgical intervention, multispiral computed tomography of the midface with 3D reconstruction was performed.

When studying the images, attention was paid to the degree and direction of displacement of fragments, the localization and nature of the fracture of the lower wall of the orbit, the presence and size of bone defects, the volume of soft tissues prolapsed into the cavity of the maxillary sinus, the changes in the parameters of the orbit and its volume. Analysis of computer tomograms was performed in 3D reconstruction and three projections: frontal, axial and sagittal, which gives a clearer idea of the nature of the fracture. It should be noted that in some cases the X-ray picture was different from the clinical situation detected intraoperatively.

In the study of control images in the postoperative period, attention was paid to the position of the fragments after the reparation and fixation of the bone fragments, the position of the implant from superelastic net titanium nickelide, the quality of restoration of the lower wall of the orbit. Control computed tomography of the midface was performed while the patient was in the hospital and one year after the surgery.

A total of 60 radiographs and 180 computer tomograms were analyzed.

Ophthalmic research methods.
All patients were consulted by an ophthalmologist and a neurologist, and appropriate medical therapy was carried out. Ophthalmological examination consisted in determining the acuity and visual fields, examination of the fundus, revealed hemorrhages and the presence of diplopia. To measure exophtalmos and enophthalmos used data computed tomography.

To evaluate the motility of the eyeballs allows traction test, which is an important diagnostic technique. For its implementation, under conditions of application anesthesia, the ophthalmic forceps captured the base of the lower rectus muscle and moved the eyeball in all directions. The test is negative, if the passive mobility of the eyeball was carried out in full, the restriction of mobility indicates the possibility of impairment of the eye muscles. This test was also performed under conditions of surgery.

Characteristics of titanium nickelide implants.
The technology for producing super-elastic net material from titanium nickelide was developed at the Medical Engineering Center of the Tomsk University under the guidance of Professor V.E. Gunther. The material is a fabric system of titanium nickelide yarns with a diameter of 60-80 microns. The distance between the filaments is 180 μm (Fig. 1). Implants in the form of rectangles measuring 3.0 * 4.0 cm are harvested from the mesh tissue and sent to the CSO. During surgery, the implant was removed from the package and placed in a physiological solution. Next, it was intraoperatively modeled using surgical scissors, based on the parameters of the defect of the lower wall of the orbit.

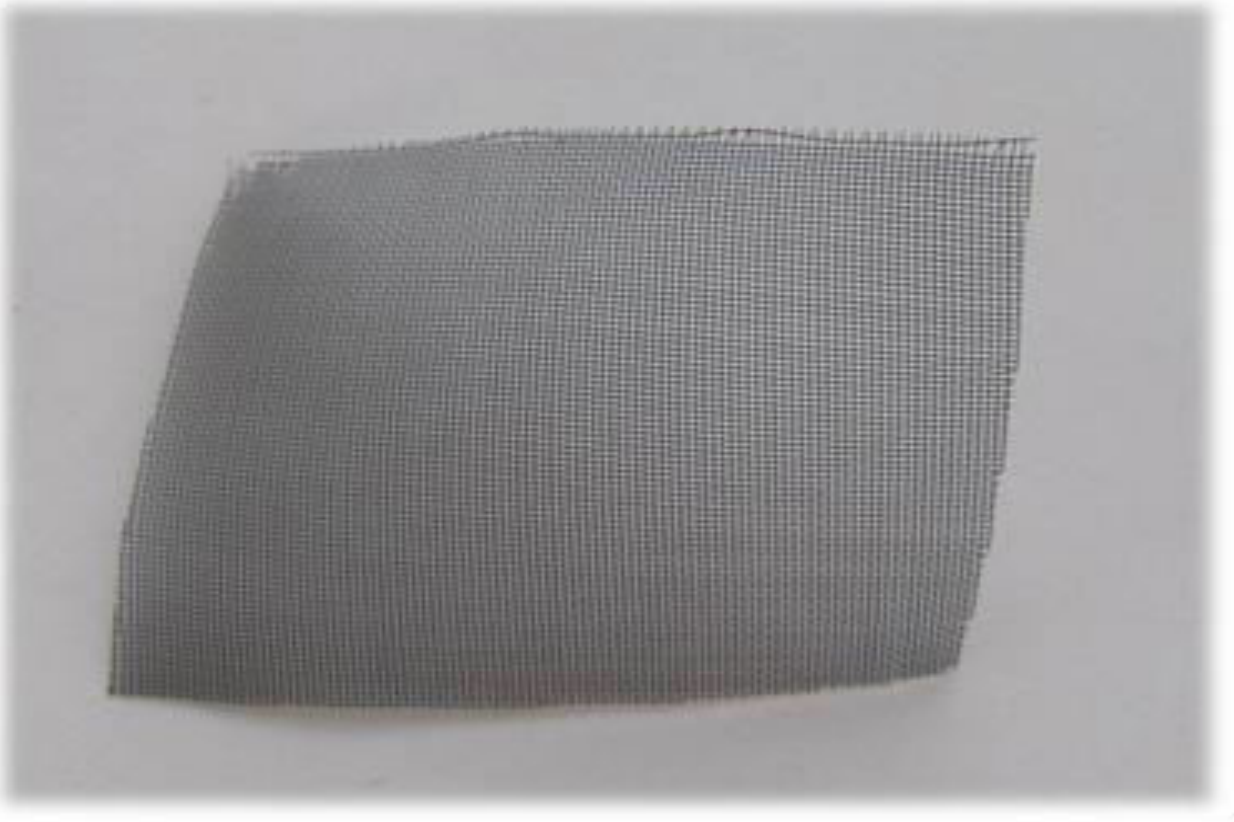

Figure 1. Implant of superelastic titanium nickelid mesh

The positive properties of this material are its elasticity, which makes it possible to easily insert the implant into the cavity of the orbit and restore the architectonics of its lower wall. High bioinertness, the ability not to cause immune reactions and inflammatory processes, the reticular structure of the implant contributes to the "germination" of tissues, and, consequently, its good fixation, preventing displacement.

RESULTS AND DISCUSSION:

All 60 patients observed by us in varying degrees showed signs of contusion of the orbital tissues: edema and eyelid hematomas, eyelid abrasions and subconjunctival hemorrhages. In all patients, the injury of the midface was combined with a traumatic brain injury of varying severity.

Clinically, the following symptoms are characteristic of a traumatic fracture of the lower wall of the orbit: impaired mobility of the eyeball, hypophthalmos, exophthalmos, diplopia, impaired sensitivity in the area of innervation n. Infraorbitalis, subcutaneous emphysema .

Fractures of the lower wall of the orbit, requiring surgical intervention in the volume of endoprothesis with a super-elastic mesh implant of titanium nickelide, were present in 48 (80%) patients with traumatic injuries of the orbital complex, in 6 (10%) - with fractures of the midface of the face type Le For II, III and in 6 (10%) - with isolated fractures of the "blowout" type.

All patients were examined by an ophthalmologist in the first days after hospitalization in the hospital, 100% of them were diagnosed with "Contusion of the eyeball" of varying degrees.

The first degree contusion was diagnosed in 42 patients with traumatic fractures of the lower wall of the orbit with exophthalmos up to 2.0 mm and a slightly pronounced restriction of the mobility of the eyeball. Clinical signs under the influence of conservative therapy gradually disappeared. Second degree contusion in 18 patients with exophthalmos over 3.0 mm and severe ophthalmoplegia. Cases of third degree contusions with damage to the lower wall of the orbit, accompanied by enophthalmos, prolonged ophthalmoplegia with simultaneous lesion of the optic nerve were not detected.

Violation of the mobility of the eyeball was diagnosed in 34 patients. Of these, 31 (91.18%) people with traumatic fractures of the zygomaticoorbital complex, 2 (5.88%) - with fractures of the midface on Le For II, III and 1 (2.94%) patients with isolated fractures of the lower wall of the orbit. In 5 cases, when the impaired motility was caused by the development of edema or hematoma, the symptoms disappeared on their own as they were resolved. A persistent dysmotility caused by the infringement of the contents of the orbit and its prolapse into the maxillary sinus, was observed in 29 patients.

Radiography in semi-axial projection was performed for all 60 patients. Indirect radiographic signs of a fracture of the lower wall of the orbit were observed in the review images: darkening of the maxillary sinus, fuzzy visualization of the damaged wall, violation of the integrity of the lower orbital margin.

According to X-ray data in classical projections, it is impossible to determine the size and extent of a fracture of the lower wall of the orbit in the anteroposterior direction, its nature. Using this method, it is impossible to assess the condition of the soft tissues of the orbit and the eyeball, and therefore, to decide on the treatment tactics and the need for surgery.

Multispiral computed tomography can be obtained with the most accurate picture of the fracture pattern. Which in recent years has been considered the "gold standard" for diagnosing an injury to the maxillofacial area, which allows for more precise planning of the volume of surgical intervention when it is necessary. It should be remembered that in case of craniofacial injury, even minor injuries can lead to significant changes in function. On this basis, the slice thickness of computed tomography should be minimal and ideally should not exceed 1.5-2.0 mm.

The method of treatment of patients with traumatic fractures of the lower wall of the orbit.

Given the complexity of the anatomical structure of the structures that make up the midface, there is a need to create a wide access for adequate reposition and fixation of fragments, as well as the formation of an aesthetic, inconspicuous scar in the future. For access to the fracture lines, depending on the nature of the damage, a subciliary, lateral brow, incision from the oral cavity in the region of the transitional fold of the maxilla and their combination were used.

Surgical treatment in the volume of endoprothesis replacement of the lower wall of the orbit with super-elastic TiNi was carried out in 60 patients with traumatic fractures of the lower wall of the orbit up to 10 days after injury.

After performing the operative approaches and repositioning the zygomatic bone into the correct anatomical position, the zygomatic bone was fixed in the area of the cheekbone articulation using fixatives of titanium nickelide with shape memory or a titanium microplate for 4 holes — 2 microscrews for each fracture fragment. Then fragments were fixed in the lower edge of the orbit, where microplates were used for 6-8 holes or mini-brackets made of titanium nickelide with shape memory, depending on the type of fracture. In the case of a finely divided fracture of the infraorbital rim, titanium microplates were used. Then they passed to the access from the side of the oral cavity, revisited the maxillary sinus and put clamps along the lines of converters. In the maxillary sinus, a Foley catheter was installed, which was brought to a working state under visual control of the lower wall of the orbit and was brought out through the defect of the front wall of the maxillary sinus.

After fixation of the zygomatic bone at three points, the bottom of the orbit was examined again for bone defects. Taking into account that the defect of the bottom of the orbit at the stage of skeletonization before repositioning the zygomatic bone could have a smaller diameter, while examining the lower wall after reposition found an increase in its parameters. After that, the implant was simulated intraoperatively using surgical scissors from the net tissue of nickel titanium in accordance with the bone defect area, inserted into the orbit and placed in the correct anatomical position. The size of the endoprosthesis must exceed the size of the defect by at least 5 mm (Fig.2). Additional implant fixation was not required. The implant took the appropriate form and was securely held in the tissues. Next, the periosteum was sutured with interrupted sutures Vicril 4.0. All this allows to reduce the time of surgery and, as a consequence, the stay of patients under anesthesia.

In the case of a comminuted fracture of the infraorbital edge, in order to avoid the contour element of the structures fixing the bone fragments, an operative technique was used, which consists in bending the implant of titanium titanium nickelide installed on the lower wall of the eye socket through the infraorbital edge (Fig. 3). Next, the periosteum was sutured. Additional implant fixation is not required.

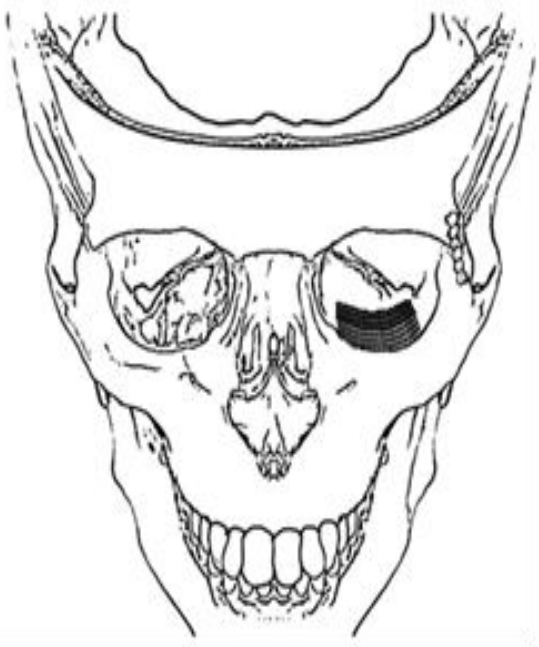

Figure 2. Individual implant on orbital flor

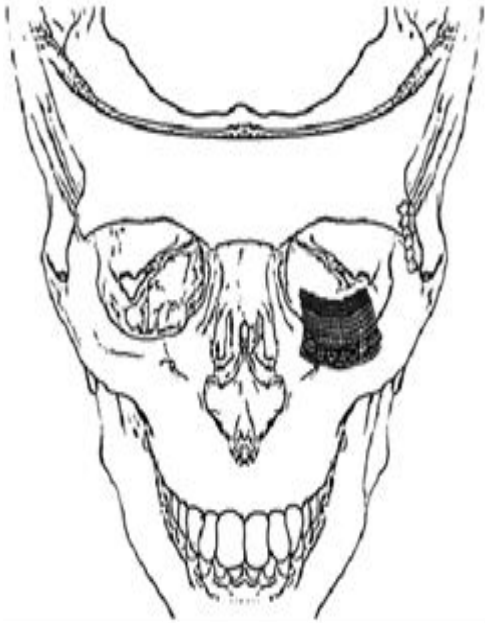

Figure 3. Method of recovery lower eye margin.

The skin and muscle flap was laid in place. The subciliary incision was sutured with Prolen 5.0 intradermal suture, latex drainage was installed in the wound. After the mucosa was sutured with continuous or interrupted sutures Vicril 4.0. The area of the catheter was placed in the area of the suture, which was tightened immediately after its extraction. In the postoperative period, the state of the eyeball was observed, the pupil's reaction to light and visual acuity were monitored.

In patients with midfacial fractures of the type Le For II and III, surgical intervention in connection with the anatomical feature of passing fracture lines, in addition to the steps described above, included additional fixation points according to contour lines.

In the case of an isolated fracture of the lower wall of the orbit, surgery was limited to the delivery of the subciliary access and the endoprosthetic replacement procedure with super-elastic titanium nickelide. In some cases, when patients noted the presence of hemosinus, an intraoral incision was performed and the anterior wall of the maxillary sinus was trepanned in order to reorganize.

CONCLUSION:

In our opinion, the method of restoring the integrity of the lower wall of the orbit with the help of implants from super-elastic titanium nickelide is quite effective, provides a good restoration of the bone structures of the orbit, a reliable position of the implant without additional fixation and simple to perform. Wound healing in all patients was performed by primary intention, suture removal was performed on the 5th day after surgery. It should be noted a small amount of discharge from the wound, which in most cases allowed to remove the drainage a day after the operation. This circumstance is of fundamental importance from the point of view of obtaining an optimal scar in the lower eyelid area. In all cases, treatment was achieved a positive result.

Damage to the lower wall of the orbit for various injuries to the bones of the middle zone of the facial skull should be considered regular. Examination of such patients should be complex, with the involvement of an ophthalmologist, a neurosurgeon and a otorhinolaryngologist.

The nature of damage to the lower wall of the orbit does not depend on the severity of local manifestations and ophthalmologic symptoms. Damage to the organ of vision of the lower wall of the orbit in the acute period after injury may be of the "subclinical" type.

The technology of treating patients with fractures of the lower wall of the orbit based on the use of reticular titanium nickelide implants has been developed and is being used in clinical practice.

The use of titanium nickelide for the restoration of the lower wall of the orbit is shown in acute trauma to the bones of the midface, when there is no atrophy of paraorbital tissue, accompanied by the formation of a defect up to 1.0 cm2. A contraindication for the use of this material is the presence of posttraumatic deformities and defects of the lower wall of the orbit with an area of more than 1.0 cm2.
When treating patients with various traumatic injuries of the bones of the midface that require restoration of the lower wall of the orbit, a mandatory preliminary step is to perform reconstructive techniques, including osteosynthesis, restoration of buttresses and walls of the maxillary sinus, decompression of the infraorbital nerve.

Long-term results tracked by us for up to 3 years. In the postoperative period, we haven't encountered any complications associated with impaired vision, infection, or a change in the position of the implant.

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REFERENCES:

1. Patel S, Andrecovich C, Silverman M, Zhang L, Shkoukani M. Biomechanic Factors Associated With Orbital Floor Fractures. JAMA Facial Plast Surg. 2017 Mar 9. 2153. [Medline].
2. Bartoli D, Fadda MT, Battisti A, et al. Retrospective analysis of 301 patients with orbital floor fracture. J Craniomaxillofac Surg. 2015 Mar. 43(2):244-7. [Medline].
3. Boffano P, Roccia F, Gallesio C, et al. Diplopia and orbital wall fractures. J Craniofac Surg. 2014 Mar. 25(2):e183-5. [Medline].
4. Bruneau S, De Haller R, Courvoisier DS, Scolozzi P. Can a Specific Computed Tomography-Based Assessment Predict the Ophthalmological Outcome in Pure Orbital Floor Blowout Fractures?. J Craniofac Surg. 2016 Nov. 27 (8):2092-2097. [Medline].
5. Kronig SA, van der Mooren RJ, Strabbing EM, et al. Pure orbital blowout fractures reconstructed with autogenous bone grafts: functional and aesthetic outcomes. Int J Oral Maxillofac Surg. 2016 Apr. 45 (4):507-12. [Medline].
6. Boyette JR, Pemberton JD, Bonilla-Velez J. Management of orbital fractures: challenges and solutions. Clin Ophthalmol. 2015. 9:2127-37. [Medline].