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TREATMENT OF ORBITAL WALL FRACTURES WITH REGARD TO VISUAL FUNCTION

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Abstract:

In recent years there has been a significant increase in childhood trauma in Uzbekistan. The number of children with orbital trauma combined with craniocerebral trauma has increased. When the orbit is injured, bone defects of its walls often occur, which require surgical intervention with the use of plastic material. The issues concerning surgical interventions with bone defects of the orbital wall remain topical nowadays. The choice of plastic materials for orbital wall reconstruction and restoration of the visual functions in children is one of the most important tasks, since the application of various donor and synthetic materials in children is considerably limited. In addition, the issues of timely diagnosis and optimal treatment of orbital wall fractures in children are still insufficiently addressed. All this determines the relevance of the present study.

Keywords: Orbital fractures, zygomatic, maxillary, frontal bone, eye socket

INTRODUCTION. Orbital fractures are one of the most common midface injuries, second only to nasal injuries. According to P. Siritongtaworn et al. (2001) fractures of the orbit make up 40% of all fractures of the facial skeleton. And the number of injuries to the orbit accompanied by the fractures of its walls is increasing (Nerobeev A.I. et al., 2012, Grusha Y.O., 2009, Kummoona 2010, Yilmaz et al., 2007). Three quarters of the victims were men. The rate of binocular vision impairment is particularly high for fractures of the lower orbital wall, and it is the most common type among all orbital fractures. Current statistics indicate an increase in the number of victims with fractures of the facial skeleton bones. Fractures of the orbital walls are most common in the zygomatic, maxillary, frontal and naso-atmoidal complex bones; isolated fractures of the orbit are rare. In 39% of cases of malar bone fractures there is damage to the lower orbital wall, in 6.6% of cases fractures are combined with injuries to the eyeball, in 25.5% of eyelids and 72.2% of facial soft tissue (Grishchenko S.V.,2012, Karajan A.S., Kudinova E.S.,2002, Meskhia Sh.M., 2009. GellrichN.C., SchrammA, 2002). Reconstruction of the orbit is a complex problem that has not yet been solved, and is dealt with by surgeons of various specialities - neurosurgeons, maxillofacial surgeons, ophthalmologists.

STUDY OBJECTIVE: correct treatment of orbital wall fractures with regard to visual function

MATERIAL AND RESEARCH METHODS

The work is based on the analysis of the complex clinical examination of 62 patients with cranio-orbital injuries, of them orbital wall reconstruction was done in 47 patients, 15 patients had isolated orbital wall injuries who were in the in-patient treatment in the maxillofacial surgery department of the dental clinic of Tashkent State Dental Institute and 2 - clinic of Tashkent Medical Academy during 2016-2019. Patients with unconsciousness and damage to vital organs were not included in our ongoing study. The most effective methods of surgical treatment of orbital base defects and deformations, complications due to each type of operation, number and kinds of repeated operations were revealed while analyzing clinical material.

Examination and treatment were preceded by informed voluntary medical consent signed by all patients with traumatic orbital injury.

Table 1.
Distribution of patients by age and sex in Group I

Age/sex	До 20	21-30	31-40	41-60	Total
man.	18	10	12	6	46 people - 74,2%
Female.	2	7	5	5	16 people - 28.8%
Total:	20	17	17	8	62 persons -100%

All patients were divided into 3 groups:

Group I consisted of 30 patients who underwent closed zygomatic repositioning with Limberg hook fixation in order to eliminate the orbital wall deformity;

Group I consisted of 4 patients who used the

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Esfil endoprosthetic mesh to repair the deformity of the lower orbital wall;

Group III - 13 people who were treated with titanium mini plates to remove the deformation of the lower orbital wall.

The reasons for the defects and deformations of the orbital base are different. Figure 1 shows that the main etiological factor is motor vehicle accidents-64% (39 patients). Domestic trauma comes second: 30.7% (19 patients). In third place is occupational trauma: 6.4% (5 patients).

STUDY RESULTS AND DISCUSSION

Patients listed cosmetic defects in the first place, and functional disorders in the second place. Thus, the "inferiority complex" that develops soon after injury in most patients with posttraumatic defects and deformities of the orbital base is exacerbated if treatment is ineffective and its duration is prolonged. The main complaints are sufficiently characteristic, in Tables 3; 4; 5 they are divided into groups and presented in absolute numbers. The data in the tables show that ophthalmological symptomatology was present in almost all patients in the acute period of injury in the majority of patients with consequences of orbital injuries. Knowledge of the main complaints allows the clinician to formulate a preliminary conclusion on the diagnosis, to specify which tactics of further examination and treatment should be determined.

When studying the anamnesis, special attention is paid to identifying the causes of injury, the timing of initial referral to a specialized medical facility, and the nature and extent of primary medical and specialized care.

The zygomatic-orbital- mandibular complex is considered to be the most complex deformity of the midface. The deformity is manifested by flattening of the zygomatic-orbital region with downward and backward displacement of the mandibular margin and the eyeball, resulting in diplopia. The inner corner of the eye is rounded, somewhat swollen and displaced downwards and forwards due to a fracture of the medial orbital wall. The deformation of the aperture can be aggravated by the ptosis of the upper eyelid. The ophthalmic symptomatology is discussed in more detail, as it leads to the greatest number of functional disorders in this group of patients. This examination is performed to determine the condition of the eye, its position in the orbit and the function of the oculomotor muscles. The simple and accessible methods used in our department usually make it possible to assess the degree of pathology and choose a treatment tactic. For a more precise and detailed assessment of the visual organ and its appendages, special instruments and devices are used; if this examination is necessary, the patient is referred to the ophthalmology departments of other clinics.

The position of the eyes in the orbit (exophthalmus, enophthalmus, lateral dislocation) is determined by a simple examination (width of the eye slits, protrusion or recession, axial position). If unilateral exophthalmus was present, translocation was measured with the comparative method, i.e. by measuring the difference of one eye stand in comparison with the other in mm, by putting a ruler in horizontal position to the bridge of nose and mentally finding the distance from it to the cornea apex of each eye. Exophthalmometers are used to estimate the degree of displacement more accurately; the simplest is a Hertel exophthalmometer. Diplopia is determined by moving an object (pencil, pen) in different directions at a distance of 1 m in front of the examinee's eyes. If doubling is present, find out where it intensifies and disappears (when looking straight ahead, vertically, horizontally, to the right, to the left). Quantification of diplopia is done by the Madzox method. Restriction of eyeball movements: the patient is asked to close one eye with the hand and follow the movement of an object in different directions with the other eye. This is used to visually determine the deficit in the amplitude of movement of each eye. Eye mobility is quantified using an ophthalmic instrument-perimeter. The visual acuity of each eye is checked separately with a standard distance test using the Golovine-Sivtsev tables, maximum visual acuity is carried out. The condition of the anterior, posterior eyeball and ocular fundus (haemorrhages, examination of the papilla, etc.) is evaluated by ophthalmoscopy. Special treatment may be prescribed to reduce inflammation and prevent scarring of the visual organ.

The ophthalmological examination consisted of determination of visual acuity and fields, examination of the ocular fundus, detection of haemorrhages and the presence of diplopia. Computed tomography data was used to measure exophthalmos and enophthalmos. Traction test, an important diagnostic method, evaluates eyeball motility. To perform it in conditions of ophthalmic anesthesia the base of inferior rectus muscle was grasped with ophthalmic forceps and the eyeball was moved to all sides. The test was negative if passive eyeball movement was performed to the full extent, limited movement indicates possible impingement of the oculomotor muscles. This test was also performed under operative conditions.

Changes in the structural features of the retina and optic nerve were studied using OCT modern technology for qualitative and quantitative assessment of the optic disc, retinal nerve fiber layer and retinal ganglion cell layer. The lesions in all cases we studied were unilateral. Concomitant severe trauma to other

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organs, including moderate and severe traumatic brain injury (severe and moderate cerebral contusion, intracranial hematomas, penetrating fractures of the skull vault and skull base) were exclusion criteria for OCT. Ocular ultrasound revealed signs of oculomotor contusion in 8 (12.8%) patients, such as increased thickness and heterogeneity of their echo structure.

Analysis of the visometry data showed that visual acuity was altered in 8 (12.9%) patients. Visual acuity (with maximum correction) equal to 1.0 was observed in 42 (67.7%) patients. In 15 (24,2%) patients visual acuity (with maximal correction) was insignificantly decreased to 0,7-0,9. Another 5 (8.1%) patients had visual acuity (with maximum correction) reduced to 0.5-0.6 (Fig.2.).

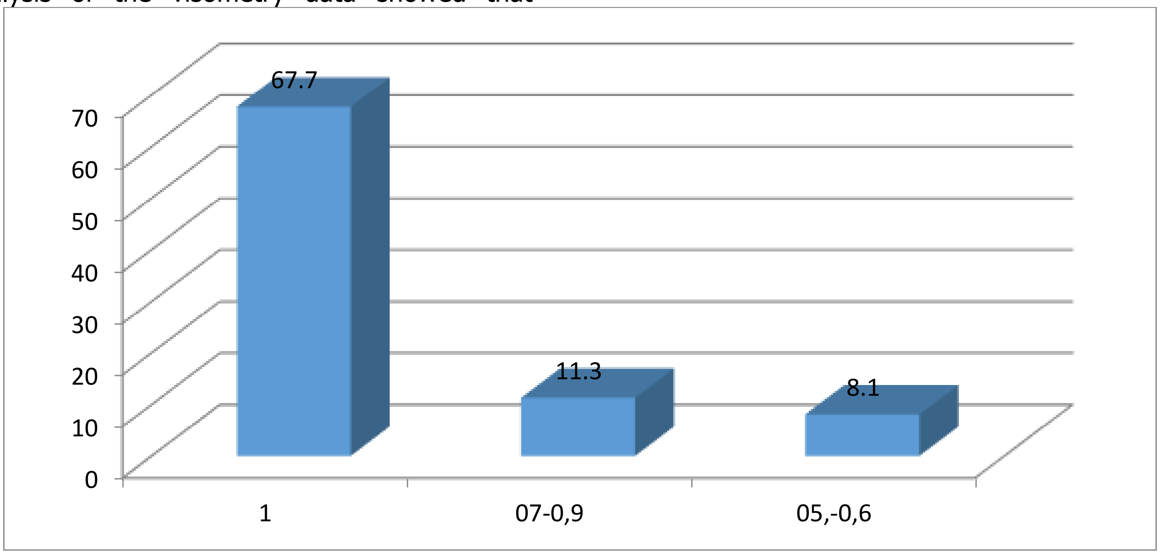

Fig.2. Changes in visual acuity in the patients surveyed

Ophthalmoscopy revealed ocular fundus changes in 26 (41.9%) patients. The traumatic angioretinopathy was diagnosed in 14 (22,58%) patients, optic disk edema due to optic nerve compression - in 5 (8,1%), anterior ischemic neuropathy - in 4 (6,5%), posterior ischemic neuropathy - in 2 (3,2%), retinal opacity in 1 (1,6%) patient. Perimetry revealed changes of peripheral visual fields in 7 (11,3%) patients, including 1 (14,5%) with traumatic optical neuropathy.

Intraocular pressure in all patients was within normal values and averaged 17.5±1.3 mmHg. When studying hydrodynamics parameters, intraocular fluid secretion index and Becker's coefficient were found to be within normal values in all patients. We also performed OCT examinations and studied the morphometric parameters of the retina and optic nerve. In the analysis of retinal thickness in three regions - fovea, parafovea, perifovea, and retinal nerve fiber layer (RNFL) - the mean values of all parameters were normal. The analysis of the studied morphometric parameters of the retina and optic nerve in patients with orbital trauma showed that in the majority of patients (70%) all parameters were within normal limits. In 13 (20.9%) cases there were deviations of 1-2 indicators and in 6 (9.6%) cases there were deviations of more than 2 indicators. In all cases, the abnormalities were subtle. As shown in Table 2, in this pathology, 100% of patients had a cosmetic defect expressed as a recession of the zygomatic and suborbital regions. Ophthalmologic symptoms occurred in almost all patients in the acute period of injury and in the majority of patients with consequences of orbital injuries.

Table 2 systematizes the clinical manifestations of orbital wall injuries.

As can be seen from the data, all patients had a cosmetic defect (100%). Ophthalmological symptomatology was manifested as oculomotor disorder in 25(41,9%), ocular dystopia and limitation of eyeball movements occurred in 18 (29%) cases. Study of the eye position in the orbit revealed that 29 patients (46.7%) had correct eye position, in 18 (29%) cases the eyes were shifted downwards. Enophthalmos and exophthalmos occurred in 16.1% and 8.06% cases respectively.

Table 2
Clinical manifestations of orbital wall injuries in patients

Symptoms	number of patients	percentage characteristic
Cosmetic defect	62	100%
Ophthalmological symptoms:		

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Oculomotor impairment	26	41,9%
Dystopia of the eyeball	18	29%
Restriction of eyeball movement	18	29%
Eye position in the orbit		
Correct position	29	46,77%
Downward displacement	18	29,03%
Enophthalmus	10	16,12%
Exophthalmus	5	8,06%
Visual acuity with maximum correction:		
Visus=1,0	42	67,7%
Visus=0,7-0,9	15	24.2%
Visus=0,5-0,6	5	8,1%
Changes to the ocular fundus:		
Angioretinopathy	14	22,58
Optic nerve swelling	5	8,1%
Anterior ischaemic neuropathy	4	6,5%
Posterior ischaemic neuropathy	2	3,2%
Berlin retinal opacity	1	1.6%

Examination of vision with maximal correction revealed that 42 patients (67.7%) had Visus=1.0, 15 (24.2%) - Visus=0.7-0.9, 5 patients (8.1%) had visual acuity between 0.5-0.6.

Radiological examination of a patient plays an important role in the diagnosis. The analysis of X-ray films of patients with the given pathology revealed the typical localization of damages at PTD of the orbital base (Table 3).

The data shown in Table 3 shows that the most frequently affected bone tissue is the lateral wall - 62.5%, the upper and lower walls - 39.1%, the orbital floor - 8.3%, and only isolated damages are 32.4%. Hence, when planning and performing reconstructive measures it is necessary to take into account the necessity and peculiarities of subsequent ocular prosthetics.

Table 3
Localisation of PTD injuries according to radiological findings

LESION LOCALISATION	NUMBER OF	PATIENTS PERCENTAGE
Medial wall	30	*62.5 %*
Upper to lower.	13	*39.1 %*
Orbital floor	4	*8.3 %*
Isolated damage to the walls of the orbit	15	*32.4 %*
Total:	62	*100 %*

In recent years, the radiological examination scheme has been supplemented by multispiral computed tomography (MSCT), which allows multiplanar reformats, fragmentary and three-dimensional images and enables a detailed study of changes in bone and soft tissue. Computed tomography (CT) allows for determining the position and degree of eyeball displacement, the direction of displacement of fat and muscle tissue together with bone fragments, the condition of the musculoskeletal apparatus of the eye and orbit, the extent of destruction of the external lower, inner and upper walls of the orbit. The use of CT scanning does not lead to abandonment of the use of observation and panoramic zonography. They are always used in combination with CT scanning, which provides the most accurate diagnostic data, on the basis of which a correct planning of the surgical intervention can be done. When predicting postoperative outcomes with programming changes in soft tissue and facial appearance, it is necessary to consider individual healing capabilities (possible soft tissue atrophy, bone resorption, scarring features), which are not reflected by computer simulation.

We performed three types of surgical interventions to correct orbital wall defects and deformities in the following picture:

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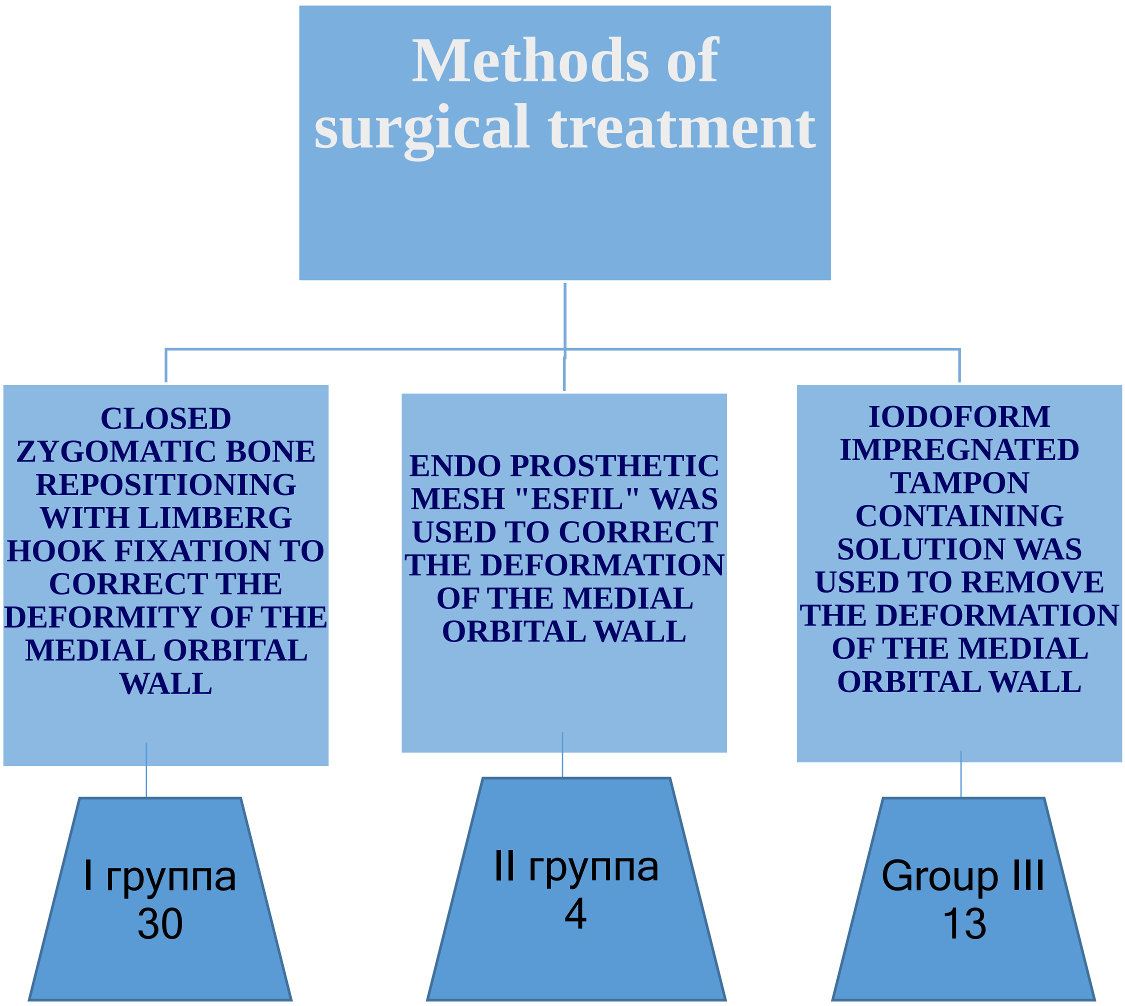

Group I consisted of 30 patients, of whom 24 (male), 6 (female), in the removal of the deformity of the medial wall of the orbit, the Limberg method was used: We used a single-toothed hook with a transversal handle. We also incised the skin to a length of 1 cm at the intersection of mutually perpendicular lines: the first goes along the lower edge of the zygomatic bone, the second goes down along the outer edge of the orbit. We inserted a single-tooth hook under the displaced fragment, picking it up from the inside and repositioning the bone (arch) in the correct position.

Group II consisted of 4 patients, 3 (male), 1 (female), in whom Esfil endoprosthetic mesh, which is mainly applied to restore the lower wall of the orbit, was used, when there was no atrophy of the para-orbital tissue, accompanied with a defect up to 1.0 cm². The Esfil mesh used could be easily modelled and implanted and functioned as a support for the orbital structures; it had a stable implanted position due to its fast integration with the surrounding tissues and was resistant to bacterial contamination.

Group III included 13 patients, among them 8 (male), 5 (female) - in whom we used an iodolicyne-impregnated tampon to eliminate the deformity of the medial orbital wall (Fig.3). Indications for the use of tampons are chronic fractures and deformities with destroyed or missing bone sections. It is advisable to use this material for defects up to 1.5 cm.

After examining the patient's CT scan, a fracture is identified in which area of the medial wall of the orbit and its position relative to the nasal passage is measured.

In the second stage, the surgical field and nasal passages are treated with antiseptic solutions under intubation anaesthesia.

In the third stage, with the help of a Volkov elevator the medial wall of the orbit is reponed through the nasal passages using movements towards the opposite side of the septum until a characteristic bone crunch, in parallel controlling the pupil line of the eyes until the alignment of the eyeballs is set.

As the fourth stage, the medial wall of the orbit is fixed in the correct position with anatomical forceps or Kocher's clamp by introducing iodociline tampons at the level of the upper and middle nasal passages;

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rubber tubes are applied to the bottom of the lower nasal passages to fix the tampons in place and improve nasal breathing.

Lastly, a bandage is placed over the nose.

Iodolicyne tampon is preferred because of its valuable physical and chemical properties: corrosion resistance, biological inertness, non-toxicity, plasticity, amagnetic properties and low specific weight.

The results of surgical treatment of defects and deformations of the orbital complex prove the high effectiveness of using iodoform tampons as a fixation material. Iodolicyne tampons were used in 13 patients of the group III under investigation. A good therapeutic effect was achieved in 88.4-89.2%. Among the complications of osteosynthesis, 2 cases of cold reaction were identified.

The use of these tampons allows performing the operations quickly and with high quality and shortens the period of treatment of the patients and prevents the development of complications related to the tissue reaction to the cold exposure and the contouring of the implant.

Surgical interventions performed on the bones of the facial skull for deformities of the maxillary complex are accompanied by significant blood loss (500 to 1500 ml). The vast majority of patients with blood loss of more than 10% of circulating blood were compensated by transfusion of donor red cell mass or whole blood during surgery or in the immediate postoperative period.

Our analysis revealed that the majority of patients with this pathology were admitted to the hospital in the late (first two days) period after injury - 56.2%. At late admission (two weeks and more) and delayed care, patients had already developed persistent segmental tissue displacements - 6.25%; scarring processes had developed at different levels (superficial, deep); structures acquired faulty memory, preserving deformity and neuromuscular function impairment. The elimination of these anatomical and functional phenomena presents significant difficulties. Among patients with early surgical intervention, diplopia and limitation of movement of the GS were transient and eliminated in the immediate postoperative period due to timely soft tissue plasty and restoration of the integrity of the bony walls of the orbit.

CONCLUSIONS: Thus, the key to optimal functional and aesthetic results of treatment is a complete diagnosis and adequate comprehensive restoration of soft tissue and bone structures in patients with pathology.

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