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Research Article

Results of surgical treatment and rehabilitation of patients with post-traumatic subatrophy and anophthalmic syndrome in combination with bone deformities of the orbit

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BACKGROUND: Ocular prosthetics remains an important and actual task in the rehabilitation of patients with anophthalmos of various origins.

AIM: To increase the effectiveness of cosmetic prosthetics in patients at the formation of a primary and/or delayed supporting stump with simultaneous reconstructive procedures on the orbital bone structures.

MATERIALS AND METHODS: A retrospective analysis of patients with subatrophy and anophthalmos with deformities of the orbital walls was carried out. Results were analyzed according to the criteria for the severity of clinical signs — enophthalmos, deepening of the superior orbitopalpebral sulcus, prosthesis mobility.

RESULTS: 22 patients with orbital bone deformities were operated and examined; they underwent surgery on the orbital walls in combination with evisceration with posterior scleral pole resection, neurectomy and implantation of a spherical endoprosthesis (in modifications) in 12 patients and delayed stump plasty in 10 patients with anophthalmos. It was possible to eliminate enophthalmos in 18 patients, to correct the retraction of the upper eyelid on the prosthesis side in 19 patients, and to significantly increase the mobility of the prosthesis in 9 patients.

CONCLUSIONS: Carrying out a combined surgical procedure aimed at restoring a voluminous mobile primary or delayed supporting stump and eliminating the deformation of the orbital walls with restoring the lost volume creates conditions for optimal individual ocular prosthetics, significantly reduces prosthesis enophthalmos, increases its mobility and improves cosmetic results of rehabilitation.

Keywords: anophthalmos; evisceration; artificial eye; titanium mesh; orbital deformation.

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Научная статья

Результаты хирургического лечения и реабилитации пациентов с посттравматической субатрофией и анофтальмическим синдромом в сочетании с костными деформациями глазницы

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Актуальность. Глазное протезирование остаётся важной и актуальной темой в реабилитации пациентов с анофтальмом различной природы.

Цель — повышение эффективности косметического протезирования у пациентов при формировании первичной и/или отсроченной опорной культи с одномоментным проведением реконструктивных вмешательств на костных структурах глазницы.

Материалы и методы. Проведён ретроспективный анализ пациентов с субатрофией и анофтальмом с деформациями стенок орбиты. Анализировали результаты по критериям выраженности клинических признаков — энофтальм, углубление верхней орбитопальпебральной борозды, подвижность протеза.

Результаты. Прооперировано и обследовано 22 пациента с костными деформациями орбиты, которым выполнены операции на стенках орбиты в сочетании с проведением эвисцерации с резекцией заднего полюса склеры, неврэктомией и имплантацией сферичного эндопротеза (в модификациях) у 12 пациентов и отсроченной пластикой культи у 10 пациентов с анофтальмом. Удалось устранить энофтальм у 18 человек, у 19 — скорректировать западение верхнего века на стороне протеза и значительно повысить подвижность протеза у 9 пациентов.

Выводы. Проведение комбинированной операции, направленной на восстановление объёмной подвижной первичной или отсроченной опорной культи и устранение деформации стенок орбиты с восстановлением утраченного объёма, создает условия для оптимального индивидуального глазного протезирования, значительно уменьшает энофтальм протеза, повышает его подвижность и способствует улучшению косметических результатов реабилитации.

Ключевые слова: анофтальм; эвисцерация; глазной протез; титановая сетка; деформация орбиты.

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BACKGROUND

According to literature data, the number of patients in need in ocular prosthetics in our country is about 400,000, the anophthalmos prevalence in the Russian Federation being 24.47 per 10,000 people [1, 2].

Out-patient departments' doctors, hospital specialists address patients to the centers for prosthetics, laboratories and cabinets for ocular prosthesis fitting, or patients may come there without medical order. At that, the care options concerning individual approach and material choice for cosmetic prosthesis are variable and depend on individual facility's focus, and on fitting methods and manufacturing variants for external prostheses adopted there [3].

It is known that to achieve high esthetic results of ocular prosthetics in a patient, it is necessary to fulfil several conditions and to follow the stages of cosmetic rehabilitation [4]. Nevertheless, for patients after various facial traumatic lesions, such as injuries of the zygomaticoorbital complex with non-integrity of orbital bone structures, not only ocular prosthetics as a mono-pathway of rehabilitation is indicated, but various options of surgical treatment is also required [5, 6]. It is related to clinical presentations in patients: insufficient or excess volume of the blind eyeball or of the preexisting functioning stump, sub-atrophy of orbital and paraorbital soft tissues, lesions of bone walls, ptosis, eyelid deformations and deepening of the upper tarsal fold on the involved side.

One of the main methods for diagnosis of patients with pathological (post-traumatic) orbital abnormalities is the multislice (multispiral) computed tomography (MSCT) of the midface according to specific algorithm [7].

Detection in patients at the MSCT of bone deformities and of post-traumatic soft tissue changes in the orbit and the paraorbital region necessitates the achievement of a complex of surgical procedures aimed to restore normal anatomo-topographic relationships in the orbit, with subsequent timely individual stepped ocular prosthetics [8–11].

In the orbital reconstructive surgery various materials are widely used as implants to form a functioning stump and to eliminate bone defects [12–14]. Each of them has own positive features and limitations. For example, allgenic materials carry a potential threat of various diseases' communication and are susceptible to resorption [15]. A multi-year research showed the safety of titaniunm material in reconstruction of orbital defects [11, 16]. Titanium possesses sufficient biological intertness and osteointegration, it has a low level of contamination, the migration in tissues in tissues after surgery is rare, it may be mould well, and visualized by MSCT [17–20].

The aim of the investigation is to increase the efficacy of treatment and rehabilitation of patients with eyeball subatrophy and anophthalmic syndrome in combination with post-traumatic bone changes in the zygomaticoorbital region.

MATERIALS AND METHODS

22 patients were examined. The material was analyzed according to the data from the laboratory of complex ocular prosthetics of Saint-Petersburg State Budget health care institution "Diagnostic Center No. 7 (ophthalmological) for adult and pediatric population" (Saint-Petersburg), of Plastic surgery clinic "Lege Artis" (Moscow), and of Clinical hospital on Yauza (Moscow) from 2018 through 2022. There were 15 male and 7 females patients.

MSCT examinations were performed according to the same algorithm ("orbit") at the Mariinsky hospital (Saint Petersburg) and at the clinic of the company group "MEDSI" (consultative and diagnostic center B, Moscow). As the implant material in primary or delayed stump, we took porous polyethylene produced by "Omnipor" company (USA), in form of different diameter spheres (18–22 mm). For bone plastics, we used 0.4 mm thick titanium meshes (plate) from the Matrix MIDFACE set (DePuy Synthes, USA).

Based on the MSCT results, a treatment and rehabilitation plan was composed, discussing with the patient their stages, time frame and rate of cosmetic prosthetics. After surgical stage implementation, individual prostheses were customized for all patients at the laboratory of laboratory of complex ocular prosthetics and mounted within the time frame 3–4 weeks, 2.5–3 and 6 months with yearly exchange of the external prosthesis (Table 1).

Operation method (repair of the orbital floor deformation)

In controlled hypotony conditions after antiseptic preparation of the surgical area according to the standard method, the lower eyelid was retracted with a lid retractor; an incision of the lower eyelid conjunctiva was made 3–4 mm away from the lower fornix, at the same time a careful coagulation of bleeding vessels was performed using the Colorado needle. The incision was made up to the lateral canthal ligament, the lateral tendon was cut at

Table 1. Types of surgical procedures (n = 22)
Таблица 1. Виды хирургических вмешательств (n = 22)

Groups	Types of surgical procedures	Number of patients
1	E without Keratectomy	7
2	E with keratotomy	5
3	Delayed plastics of the functioning stump	10
1, 2, 3	Reconstruction of orbital walls	22

Note. E — evisceration with scleral posterior pole resection, neurectomy, and implantation of a spherical polymer endoprosthesis.

the lower peduncle, then we passed depthward up to the anterior orbital rim, performing a delicate tissue dissection by Westcott scissors, at that the orbital septum has to be well visible, the dissection was continued posteriorly to the orbicular muscle of the eye. Additional coagulation was performed by mono- and bipolar coagulator. The anterior orbital rim was completely uncovered by a raspatory, further 1 traction suture (4–0) was placed onto the edges of the conjunctival incision from the eyeball's side and fixed it on a vascular clamp for better visualization of the surgical approach. Then the orbital septum was opened. In the case of herniation, hernias were not hurt and not coagulated to preserve fat packages. The orbital floor was skeletonized to the orbital apex, liberating it from scar tissue and mobilizing fallen out orbital hernias from adhesions with maxillary sinus mucosa. In presence of the internal wall deformation (in 14 patients), a tissue dissection was carried out over the defect area to the undamaged zones. Soft tissues were lifted above the fracture or deformation area with an orbital retractor, a mold custom titanium mesh was introduced, which completely overlapped the bone defects area, with visual control of the position of the distal part of the mesh. The mesh was fixed with screws to undamaged bone structures of the orbital rim. Conjunctival incision edges were sutured with a running suture (Vicryl 6/0).

Hereafter, we passed to the surgical step on the blind eyeball (evisceration in several combinations) — 12 patients, or to a delayed plastics of the functioning stump — 10 пациентов — in accordance with our previously elaborated methods [11].

Evisceration without keratectomy (7 patients). A dissection of the conjunctiva and of the Tenon's capsule was performed in 5–6 mm posteriorly to the limbus, a linear more than 10 mm long incision of the sclera was done with a blade parallel to the limbus all over scleral thickness. A cyclodialysis cannula or a corneal scraper was introduced into the space between the sclera and uvea, and uveal tissues were separated in circular motions in the scleral spur area. Under visual control, the intraocular content was completely removed. The scleral pocket cavity was carefully processed with iodine alcohol solution, 70% ethyl alcohol, and then a careful curettage of uveal remnants in the areas of emissaria was performed. A scleral puncture with a No. 11 blade in 3–5 mm laterally to the optic disc was done. The optic nerve was separated by blunt dissection under visual control using scleral scissors; the nerve was squeezed and then cut in 7–10 mm from the posterior pole of the eyeball. Scleral bands around the optic nerve were removed in 12–15 mm diameter without damaging oblique muscles. Additionally, 6–10 large scleral relaxing incisions in 4 quadrants between the recti muscles were made. Into the created cavity, a spherical implant was placed, without bringing any changes to its construction. 3–4 interrupted scleral sutures (Vicryl 5–0), a running suture on the Tenon's fascia and conjunctiva were used.

Evisceration with keratotomy (5 patients) differed from the method described above. A circumferential conjunctival peritomy in 5–10 mm from the limbus was done. Two mutually perpendicular corneoscleral incisions were performed getting under 45° angle to recti muscles tendons. Further surgical steps were accomplished according to the method described above. The procedure was finished by placing inverted-U-shaped sutures on corneoscleral flaps, purse-string suture — on the Tenon's fascia and conjunctiva (Vicryl 5–0). On the lateral canthus, an interrupted suture 5–0 was put. Into the cavity, a plastic transparent conformer was placed with consideration to dimensions of the conjunctival cavity.

In the absence of the eyeball in the orbit, a ***surgical delayed plastics of the functioning stump*** (10 patients) was performed according to the defined method.

With a blade, a horizontal incision of the conjunctiva through the functioning stump's center up to 18 mm, conjunctiva was separated horizontally and vertically. The posterior part of the Tenon's capsule was cut by blunt dissection, and a cavity in the muscular funnel was formed. A meticulous hemostasis was carried out,

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into the formed cavity a spherical implant was placed using an orbital injector, the implant's parameters being calculated according to previously obtained data. Interrupted sutures were put on the Tenon's capsule, a running suture — on the conjunctiva (Vicryl 5–0). The operated orbit was covered by a solid compressive bandage for 48 hours with following everyday exchange.

RESULTS

During the whole follow-up period, 3we performed a reconstruction in 22 patients carrying out a combined procedure — repair of bone deformations and simultaneous functioning stump formation (primary and delayed).There were 15 male and 7 female patients. The age range was from 18 to 67 years. Most patients (13) were aged from 26 to 40 years. Mean age of patients was 36.04 years (Table 2).

Most prevalent causes of the eye loss were car accident, sports-related injury, and home accident (Table 3).

The duration of the anophthalmic syndrome's (AS) presence in 10 patients with combined bone deformations distributed in the following order: less than 1 year — 3; 1–3 years — 4; 3–5 years — 2; more than 5 years — 1. As one can see, in most of the patients anophthalmos (condition after enucleation) with a deformity of orbital bones existed no more than 3 years. At that, almost a half was composed by patients with anophthalmos duration of less than 1 year.

17 patients had paresthesiae in the area of the suborbital nerve distribution. In 21, movement limitations of the eyeball (stump) upwards, in 14 — in primary positions of gaze were revealed.

Surgical results according to the degree of clinical manifestations [11] are summarized in Tables 4–6.

In all 22 patients before surgery, different degree of enophthalmos was revealed (Table 4). Postoperatively, the prosthesis enophthamos (of no more than 3 mm) was found in 4 people. In remaining patients, enophthalmos was successfully repaired. This effect was obtained due to the orbital volume restoration, which was adequate

Table 2. Age of patients
Таблица 2. Распределение пациентов по возрасту

Age	Number of patients
18–25	2
26–40	13
41–55	5
56–67	2
Total	22

Table 3. Distribution of patients according to the cause of the injury
Таблица 3. Распределение пациентов по причине травмы

Causes	Number of patients
Car accident	14
Sports-related injury	1
Home accident	5
Occupational injury	2

Table 4. Evaluation of results according to the enophthalmos degree
Таблица 4. Оценка результатов по степени выраженности энофтальма

Enophthalmos degree	Group 1		Group 2		Group 3	
	before	after	before	after	before	after
0	0	6	0	4	0	8
1	2	1	1	1	0	2
2	2	0	2	0	4	0
3	3	0	2	0	6	0

Table 5. Evaluation of results according to the orbitopalpebral sulcus manifestation degree
Таблица 5. Оценка результатов по степени выраженности углубления орбитопальпебральной борозды

Degree of the orbitopalpebral sulcus deepening	Group 1		Group 2		Group 3	
	before	after	before	after	before	after
0	0	6	0	4	0	9
1	5	1	3	1	1	1
2	2	0	2	0	4	0
3	0	0	0	0	5	0

Table 6. Evaluation of results according to the degree of prosthesis mobility
Таблица 6. Оценка результатов по степени подвижности протеза

Degree of cosmetic prosthesis mobility	Group 1		Group 2		Group 3	
	before	after	before	after	before	after
0	0	0	0	0	0	0
1	1	0	2	0	9	3
2	2	1	3	4	1	5
3	4	6	0	1	0	2

to the functioning stump, form and parameters of the external cosmetic prosthesis.

In accordance with the manifestation of the sign “deepening of the upper orbito-palpebral sulcus” (Table 5), we found that before surgery such clinical situation most expressed in patients, in whom anophthalmic syndrome was combined with orbital bone deformities (3rd group). This was due to large, long-term changes in soft tissues in terms of its subatrophy, insufficient volume of the functioning stump, increased orbital volume because of bone destruction.

In all cases, it was possible to eradicate patients’ complaints on paresthesiae in the course of the first year after surgery.

MSCT carried out in 17 patients in 6 months showed a correct position of the titanium mesh implant, which completely closed the bone defect’s area. There were no complications revealed, such as significant hemorrhages, infection, rejection of implanted materials and implants. All patients were satisfied with acquired cosmetic results of surgical repair and of individual eye prosthetics.

CLINICAL EXAMPLE

As an example of successful complex approach, we present a clinical case. A 50-year old patient addressed with complaints on blind, hollow, inflamed and disfiguring the face left eye. From the history, it became known that the man received a left eyeball injury with complete vision loss as a result of home accident. He immediately referred to a medical institution in the home area, where, in the patient’s words, first medical care was provided in the extent of primary surgical procedure for the eyeball injury. In the postoperative period, visual functions did not recover. Later on, he was under follow-up of the ophthalmologist in the home area, received repeated courses of medical treatment. In the patient’s words, left eyeball progressively decreased in size and became more deeply positioned in the orbit, stayed inflamed and tender when touched through the eyelid. The patient was examined at the clinic, the examination’s result: visual acuity of the left eye — NLP, intraocular pressure — hypotony, deformation of the cornea, cloudy anterior chamber, deeper media not visible. Edema of the bulbar conjunctiva. Partial upper eyelid ptosis, deepening of the upper orbito-palpebral sulcus and its irregular profile (Fig. 1), limitation of the eyeball upward movement. At the consultative and diagnostic center B of “MEDSI” (Moscow), MSCT of the orbits was carried out to the patient. Analyzing the images, we found a bone deformity of the floor and of the medial wall of the left orbit with increased volume of the left orbit (Fig. 2, 3), left eyeball subatrophy with increased optic nerve thickness. Taking into consideration a presence of a blind, inflamed and disfiguring left eyeball with ocular tenderness, we decided to give up its prosthetics, and recommended a combined surgical treatment which included a reconstructive procedure on the left zygomaticoorbital complex with a defect restoration of the floor and the medial wall of the left orbit, mold with a titanium mesh and simultaneous evisceration with posterior pole resection, neurectomy, and implantation of a spherical polymer (porous polyethylene) implant under combined general anaesthesia. Surgical procedure was performed following the method described above. At the early post-op period, medical treatment was carried out, aimed at prevention of inflammatory events under a compressive bandage (Fig. 4). Later on, individual eye prostetics was performed within standard timeframes (4 weeks, 2.5 and 6 months after surgery).

The patient addressed in 2 years (Fig. 5) for pterygium removal on the right eye. A control MSCT of the orbits was done (Fig. 6, 7). He was satisfied by the result of treatment and rehabilitation (prosthetics) of the left orbit.

DISCUSSION

Eyeball injuries wit loss of visual functions in combination with orbital bone lesions are not the conditions directly imminent to the life, but the destruction of upper orbital wall, but the destruction of the upper orbital wall makes dramatically more difficult the state of the patient, and this demands more prompt and serious care [21].

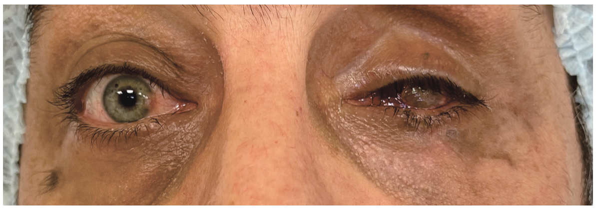

Fig. 1. General view of a 50 y.o. patient before surgery — 6 months after injury. Subatrophy of the left eyeball, chronic uveitis, deformation of the conjunctival cavity, ptosis of the upper eyelid, deep orbitopalpebral sulcus

Рис. 1. Общий вид пациента 50 лет перед операцией — 6 мес. после травмы. Субатрофия левого глазного яблока, хронический увеит, деформация конъюнктивальной полости, частичный птоз верхнего века левого глаза. Глубокая орбитопальпебральная борозда

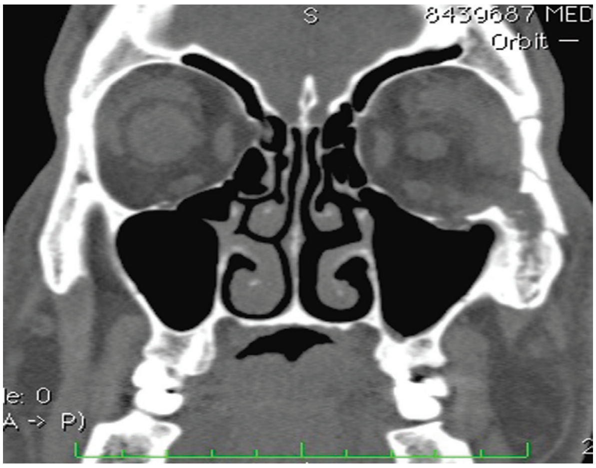

Fig. 2. Patient, 50 y.o. Multispiral computed tomography before surgery. Front view. Posttraumatic deformity of the inferior and the temporal walls of the left orbit. Increased socket volume

Рис. 2. Пациент, 50 лет. Мультиспиральная компьютерная томография до операции. Фронтальный вид. Посттравматическая деформация нижней и наружной стенок левой орбиты с увеличением объёма глазницы

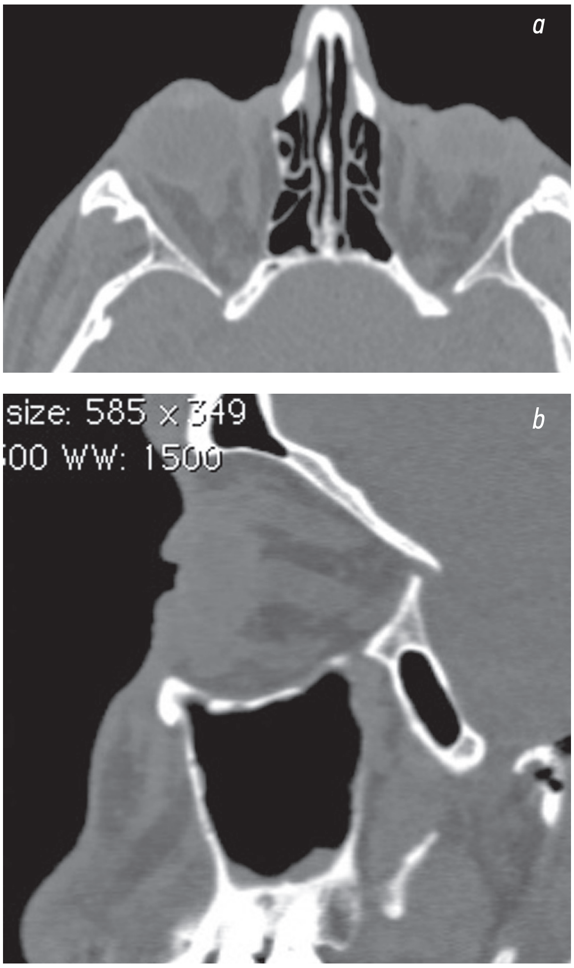

Fig. 3. Multispiral computed tomography before surgery: *a* — axial sections; *b* — sagittal sections. Socket deformity . Increased socket volume. Posstraumatic eyeball subatrophy

Рис. 3. Мультиспиральная компьютерная томография пациента до операции: *а* — аксиальный срез; *b* — сагиттальный срез. Деформация левой орбиты с увеличением орбитального объёма. Посттравматическая субатрофия глазного яблока

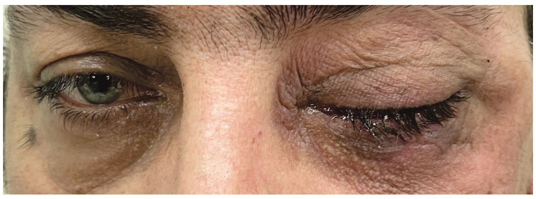

Fig. 4. General view of a 50 y.o. patient on the 2nd day after surgery. Edema of orbital tissues. Absence of the orbitopalpebral sulcus deepening

Рис. 4. Общий вид пациента на 2-е сутки после операции. Небольшой отёк мягких тканей орбиты, отсутствие углубления орбитопальпебральной борозды

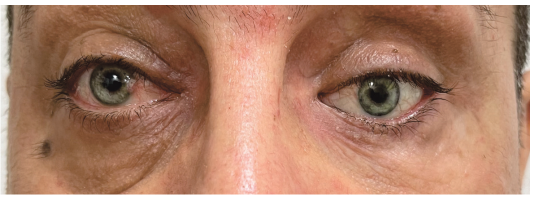

Fig. 5. General view of the patient 2 years after surgery. A prosthesis is installed in the left cavity (Laboratory of complex eye prosthetics, Saint Petersburg)

Рис. 5. Общий вид пациента через 2 года после операции. В левой конъюнктивальной полости установлен индивидуальный косметический протез (лаборатория сложного глазного протезирования, Санкт-Петербург)

Often, such conditions drive to deliver medical care to a patient in as a multidisciplinary team of specialists [5]. Orbital floor injuries, as a part of facial skull fractures may combine not only with eyeball trauma with visual function loss, but also with several face deformations [8].

Masquerading behind soft tissues' edemas and hematomas, the trauma of orbital floor (and of other orbital walls) stresses the importance and timeliness of imaging, from the accuracy in diagnosis of which would depend the preoperative planning and the number of surgical procedures in this area.

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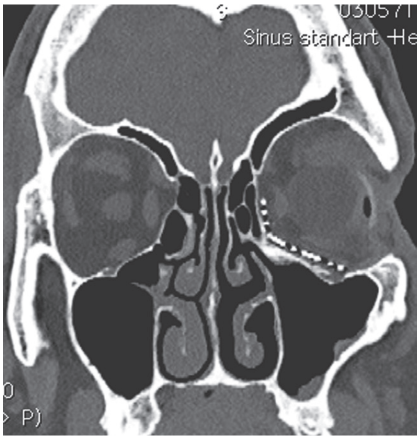

Fig. 6. Multispiral computed tomography. Frontal view. Two years after surgery. Titanium mesh over the zone of the defect. Spherical implant and external cosmetic prosthesis in the orbital cavity
Рис. 6. Мультиспиральная компьютерная томография. Фронтальный вид. Через 2 года после операции. Титановая сетка над зоной дефекта. В левой глазнице — сферичный имплантат и наружный косметический протез

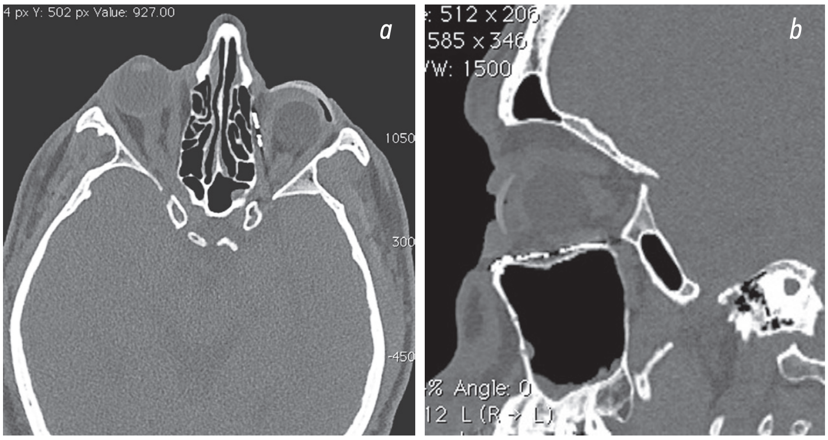

Fig. 7. Multispiral computed tomography: *a* — axial view; *b* — sagittal view. Titanium mesh over the defect zones. Prosthesis is congruent to the stump shape
Рис. 7. Мультиспиральная компьютерная томография: *a* — аксиальный вид; *b* — сагиттальный вид. Сетка над зонами дефектов. Косметический протез конгруэнтен передней поверхности опорной культи

In partial and delayed care, often arise unfavorable esthetic and functional results. Orbital bones (mostly orbital floor and medial wall) are fairly thin, and this makes them prone to fractures and deformations [22].

The “blow-out” fracture term — the injury to the orbital floor, was first introduced by J.M. Converse and B.C. Smith. The development mechanism — because of action of forces and dimensions of the object, acting on the weakest point in the orbital bony walls due to the increase of intraorbital pressure, at that periorbital soft tissues or muscles may be displaced by gravity into the maxillary sinus and ethmoid sinuses. The orbital rim is steadier [23].

Most often (according to literature data) orbital fractures and subsequent deformations occur in male patients and adolescents [24]. These data completely match with our results. In our work, we investigated 22 adult patients with orbital fractures, 15 from them were men, mean age was 36.04 years. Car accident was the most frequent cause (14 patients), domestic conflicts (5), and sports-related injuries (1). This corresponds to the World’s statistics on trauma epidemiology [25–27].

In all patients, post-traumatic changes in orbits lined up with paresthesiae in the area of the suborbital nerve distribution. We revealed eyeball movement limitations in upgaze in all patients with eye subatrophy and limitations of movements of the functioning stump in patients with anophthalmic syndrome. In all patients, enophthalmos of the eyeball or that of the external cosmetic prosthesis was diagnosed.

All patients addressed our clinic not at an early date after injuries, but at a period from 2.5 to 120 months (27.2 months in average).

We succeeded in achieving several planned objectives in all cases: to reduce soft tissues of the orbit from the sinuses, to close the bone tissue defect, to create a steady foot for the implant and the formed functioning stump, to eliminate possible limitations for the extraocular muscles’ functioning, and to restore the orbital volume.

In the present work, we used the transconjunctival approach for orbital wall procedure.

The choice of implantation materials for orbital bone defect reconstruction and of materials for functioning stump formation is still under discussion [28]. The treatment of combined deformations has to include defect closure with such material that could ensure a steady and prolonged structure support to orbital soft tissues, could integrate with scar tissues, and be able to mold to repeat curvatures of the orbital floor bone architecture. Until now, there is no consensus on an ideal material for orbital floor defects reconstruction [29, 30]. Free bone transplants, taken from the parietal bone or ribs continue to be widely used, but the utmost shortage is an unpredictable resorption and an additional surgical field [31].

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The use of titanium constructions in reconstruction of facial bones is largely enough discussed in literature, at that the material showed its advantages in biological inertness [16]. Besides, it is known that in analysis of titanium implant in the area of paranasal sinuses, the mesh was subject to gradual union with soft tissues, was later restored by local cells, including respiratory epithelium and goblet cells. This is important in contact of the material with paranasal sinuses and oropharyngeal area [32]. To restore post-traumatic defects with deformations of orbital walls, we used a sterile titanium mesh. We did not face any complications such as postoperative injuries of surrounding soft tissues, development of infectious processes and displacements. Such positive feature of the titanium mesh as porosity (better ingrowth of the fibrovascular tissue) in the situation, when for some reasons its removal is needed, is an unfavorable moment, demanding additional measures for its removal [33]. Care should be taken when positioning the mesh, if at the molding process it is necessary to cut the protruding margin to prevent the soft tissue entrapment at its fixation [17].

The use of titanium mesh as of an implant in restoration of bone defects of orbital floor and orbital walls allows significantly improving and preserving the functional and esthetic result on a stable level; and, to our mind, it could be considered as an optimal option when performing combined procedures on an anophthalmic socket.

The choice of an implantation material on the base of porous polyethylene in the form of spheres of various diameter allows to obtain a stable result in formation of a voluminous locomotor stump (primary or delayed), timely and consecutively resolve questions of an individual staging eye prosthetics with pre-positioned conformer in the conjunctival cavity.

Single-stage procedures on a blind eye or by a delayed character of functioning stump formation in combination with elimination of post-traumatic defects and deformations of orbital bone walls create conditions for an optimal external prosthetics and promote a reduction of rehabilitation terms for patients with various manifestations of post-traumatic anophthalmos.

CONCLUSION

Orbital fractures and deformations are at times directly related to eyeball injuries and/or intracranial injuries as to a part of complex deformities of mid-face structures. Until recent times, car accidents were considered to be one of the most prevalent causes of the development of such conditions. Comprehensive clinical examination of such patients, together with adequate MSCT, is a gold standard for evaluation of severity of their status, treatment planning, rehabilitation, and control of the carried out treatment at various terms after completed procedure. Different approaches exist in surgical treatment of orbital post-traumatic deformations and in methods of functioning stump formation. Titanium mesh continues to be actively used by surgeons for reconstructive-restorative objectives in bone lesions of the facial skull. Porous polyethylene in the shape of spheres is known by ophthalmoplastic surgeons as a material for primary or delayed functioning stump formation. Widely adopted practice of ophthalmic surgeons with maxillo-facial surgeons and/or ORL specialists, neurosurgeons is aimed to complete a most comprehensive program of surgical treatment. Close collaboration of surgeons with prosthetists on routine basis allows working out together the rehabilitation plan for this complex category of patients and to gain high cosmetic and functional results in prosthetics for anophthalmic patients.

ADDITIONAL INFORMATION

Author contribution. Thereby, all authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

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