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**CONTROVERSIES REGARDING ORBITAL
DECOMPRESSION IN PATIENTS WITH
SEVERE THYROID OPHTHALMOPATHY***

**KONTROVERZE O DEKOMPRESIJI ORBITE
U BOLESNIKA SA TEŠKIM OBLIKOM
TIROIDNE OFTALMOPATIJE***

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*Rad po pozivu

Abstract

Ključne reči

orbita, tiroidna oftalmopatija,
egzofthalmus, dekomprezija orbite,
očni kapci, retrakcija očnih kapaka,
strabizam

Key words

orbit, thyroid ophthalmopathy,
exophthalmos, decompression of the
orbit, eyelids, eyelid retraction,
strabismus

Introduction Conservative therapy in cases of severe thyroid ophthalmopathy has not given satisfactory results. Because of this, surgical treatment, i.e. orbital decompression, is now used with increasing frequency. Different methods of orbital decompression implemented with different results, conclusions and controversies.

Patients and Method Since the end of 1986, 112 patients with severe thyroid ophthalmopathy have been treated by personal three-wall orbital decompression combined with removal of the periorbital, intraorbital and retrobulbar fat, as well as, with correction of eyelid retraction and deformities.

Results After operation all patients showed a significant reduction of exophthalmos (5-11 mm., on average 7,2 mm), correction of eyelid retraction and deformities, improvement of vision, significant reduction of intraocular pressure, marked improvement in ocular muscle function, as well as considerable reduction or disappearance of subjective symptoms. There was no cases of subsequent impairment of vision or ocular motility. Strabismus surgery is performed in 6 patients due to unsatisfactory correction of diplopia. Les evident relapse was recorded in only 3 cases and only in one patient was unilateral reoperation required. Significant aesthetic improvement has been achieved in all patients.

Conclusion This method of orbital decompression is logical, based on an understanding of the pathology, is less hazardous, is relatively easy to perform, gives constantly very good functional and aesthetic long term results and allows rapid recovery

INTRODUCTION

Thyroid ophthalmopathy /TO/ affects orbital contents and eyelids. Aetiopathogenesis of this disease has not still been explained. Beside a number of hypotheses and theories, the prevailing option is that it is actually an autoimmune multifactorial process. Numerous articles on the autoimmune pathogenesis and pathophysiology are in many ways speculative and controversial. Controversial are the facts about what is primary in the autoimmune process, who is responsible for common antigens in the orbit and in the thyroid gland, then about the function of the circulating antibodies against the extraocular muscles and the fibroblast component etc.

The most frequent and most significant manifestations of the TO are: exophthalmos – proptosis, swollen eyelids with distinct retraction, hyperemia and chemosis of the conjunc-

tiva, various changes of the cornea and optic nerve, and double vision, sometime with strabismus, because of swelling, thickening, elongation and fibrosis of the extraocular muscles.

Since the conservative therapy of marked TO does not usually give satisfactory results, the surgical treatment is used more and more often nowadays. Surgical procedures include operations on the eyelids, operations on the extraocular muscles and different methods of orbital decompression, i.e. removal of different parts and size of orbital walls and orbital fat.

There are numerous controversies concerning different methods of orbital decompression, results of orbital decompression, especially concerning postoperative diplopia.

The aim of this work is to present long-term postoperative results in patients with severe thyroid ophthalmopathy

after applying personal method of 3 wall orbital decompression combined with removal of orbital fat and correction of eyelid retraction and deformities.

PATIENTS AND METHOD

Since the end of 1986, 112 patients with severe TO / exophthalmia 24-33 mm / were treated surgically using personal method of orbital decompression along with correction of the eyelid retraction and deformities. There were 86 women at the age 17 to 73 and 26 men at the age 22 to 53. The majority of the patients had typical clinical symptoms and findings of TO.

Decompression of the orbits is performed after complete endocrine and ophthalmic assessment and treatment. The procedure for the correction begins within the upper eyelid /

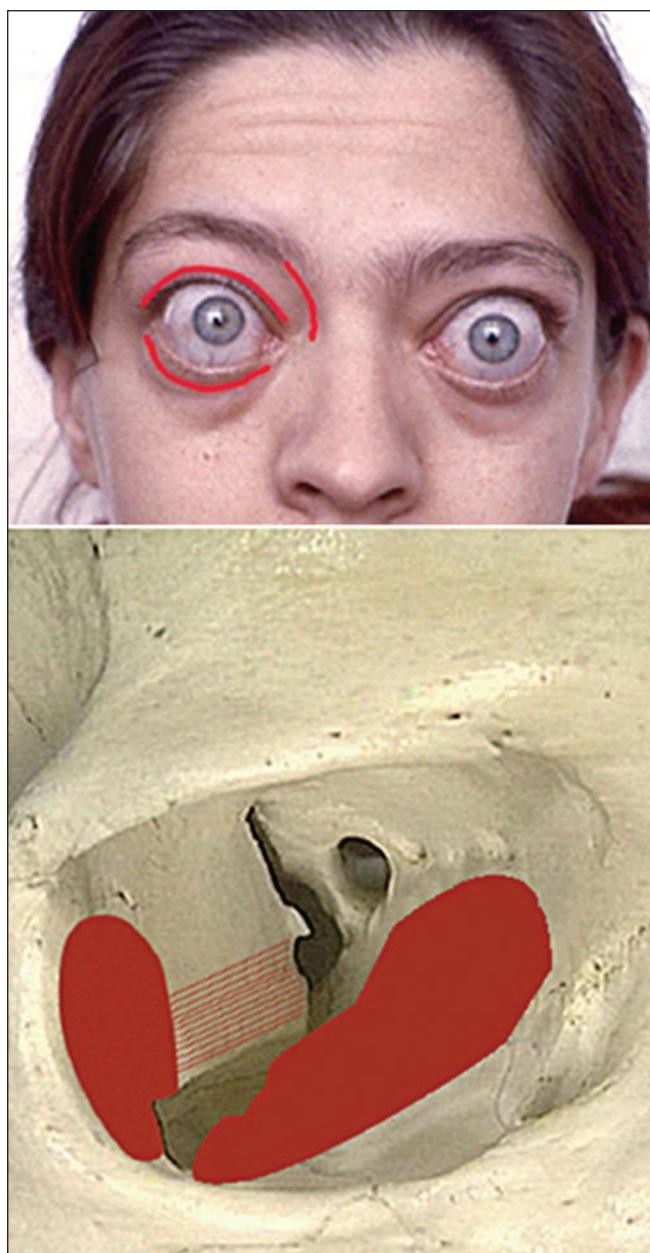


Fig. 1. The approaches to the orbital walls are marked on the eyelids. The surgical bony defect is marked on the orbital walls.

Fig. 1 /. As for a blepharoplasty, the excision of the excessive eyelid skin and swollen subcutaneous tissue is performed and the eyelid fat and fat of upper part of orbit is removed. In order to obtain the correction of upper eyelid

retraction, the central part of the aponeurosis of the levator muscle and Muller's muscle are excised. Following this, an incision is made in the lower eyelid, 2-3 mm below the margin, and through this, the floor and lateral wall of the orbit are explored and periorbital and intraorbital fat is removed, as much as possible. Using a small chisel and hemostat, the posterior, retrobulbar part of the orbital floor and the lateral orbital wall, except lateral orbital margin, are removed /Fig. 1 /. The bony bridge between the floor and lateral orbital wall defect is removed to produce a large continuous orbitectomy. The size of the defect is related to the severity of the exophthalmos. An attempt should be made to remove the bone from the orbital floor as close to the orbital apex as possible. The anterior, bulbar part of the orbital floor must remain intact. The infraorbital nerve is protected during the floor osteotomy. This is achieved by removal bone on either side of nerve and then freeing the nerve. If the bone bridge in the infraorbital nerve region is left, the effect of decompression is significantly diminished. If possible, the sinus mucosa should not be opened. Small perforations of the sinus mucosa are frequently unavoidable, but are of no importance. Wide incisions or excisions of periorbital periosteum should be made in several sites. Following this, through an incision made over the medial margin of the orbit, the medial orbital wall is explored and its ethmoidal part is removed / Fig. 1 /. This medial wall bone defect should be in continuity with orbital floor defect, i.e. retrobulbar part of orbital strut should be removed. During the medial wall osteotomy, the bone at the region of the upper border of ethmoid bone must be intact. The bone defect begins about 2-3 mm below the ethmoidal foramen. This is done in order to prevent injury and bleeding of the ethmoidal arteries and to prevent the breaking into scull cavity and damage dura. Using this same approach, the retrobulbar space is explored, and again, as much as possible, retrobulbar fat is removed with a hemostat. The periorbital periosteum in this region should be excised or incised at several sites. In the patients with distended, hypotonic, ptotic lower eyelids it is necessary to perform the lateral canthopexy or to perform shortening of eyelid by excision of central part of eyelid rim, about 3 mm wide. After establishment of satisfactory hemostasis, a thin



Fig. 2 a,b Patient with exophthalmos of 28 mm, diplopia and eyelids deformities, before /a/ and 3 months after the operation /b/, without diplopia.

vacuum drain is inserted into retrobulbar space, and the incisions on eyelids are closed. At the beginning of the operation, temporary blepharorrhaphy should be performed using two single sutures. These sutures are removed 5-7 days after the operation. Postoperatively the eyesight is controlled through central part of the eyelids, between the two sutures.



Fig. 3 a, b, c Patient with asymmetric exophthalmos, diplopia and eyelids deformities, before /a/, 3 month after the operation /b/ and 3 years after operation /c/, without diplopia.



Fig. 4 a, b Patient with unilateral ophthalmopathy with diplopia, before /a/ and one year after the operation, /b/ without diplopia

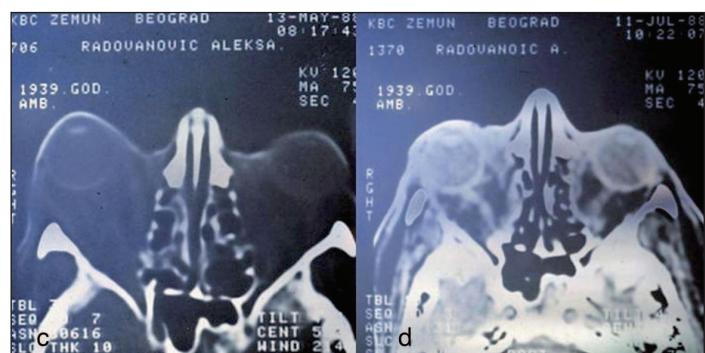
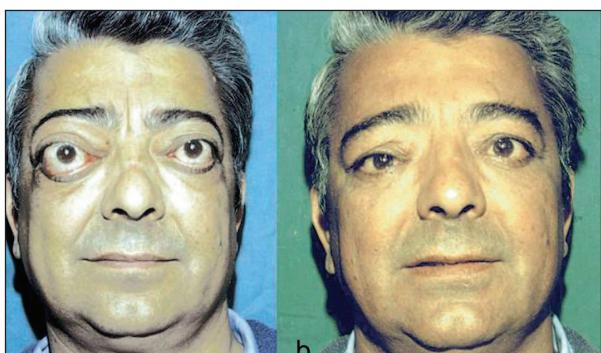


Fig. 5 a, b, c, d Patient with asymmetric exophthalmos of 32 mm, diplopia and eyelid deformities, before /a/ and 2 months after the operation /b/, CT of the orbits before /c/ and 2 months after the operation /d/, without diplopia.

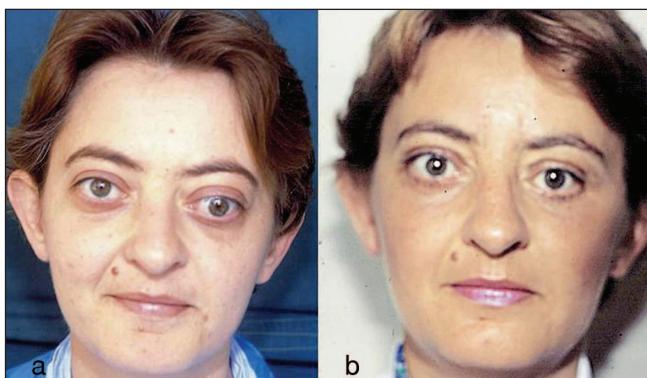


Fig. 6 a, b Patient with exophthalmos of 28 mm, strabismus, diplopia and eyelid deformities, before /a/ and 3months after the operation /b/, without diplopia.



Fig. 7 a, b Patient of 17 years after strumectomy with asymmetric exophthalmos and strabismus / changes on the eyes are worsened after strumectomy/, before /a/ and 2 months after operation /b/, without diplopia



Fig. 8 a, b, c, d, e Patient with asymmetric exophthalmos of 28 mm and severe strabismus, before /a,b/ and 11 days operation /c,d,e/, with diplopia on lateral gaze.



Fig. 9 a, b Patient after Naffziger's neurosurgical orbital decompression / orbital roofs are removed / and radiation therapy with eyelid deformities, pulsatile exophthalmos of 30 mm and with blindness on the left, before /a/ and four years after described orbital decompression and osteoplasty of the orbital roofs /b/.



Fig. 10 a, b Patient with exophthalmos of 30 mm, diplopia and eyelid deformities, before /a/ and 3 month after the operation /b/, without diplopia.



Fig. 11 a, b, c, d, e Patient with malignant exophthalmos of 33 mm with strabismus before /a/ and 3 weeks after the operation /b,c,d,e/



Fig. 12 a, b, c Patient with exophthalmos of 30 mm and eyelid retraction, before /a/ and after 2 years /b/ and 9 years /c/, without diplopia



Fig. 13 a,b Patient after strumectomy with exophthalmos of 32 mm and with eyelid retraction and deformities / changes on the eyes are worsened after strumectomy /, before /a/ and 3 months after operation /b/, without diplopia



Fig. 14 a, b Patient after inadequately antral-ethmoidal decompression with injury to extraocular muscles, before /a/ and 3 weeks after described decompression of the orbits and chondroplasti of anterior, bulbar part of orbital floors /b/. It is necessary to perform additional correction of left lower eyelid.



Fig. 15 a, b Malignant TO with bilateral blindness /a/ and 7 days after operation /b/. The vision is improved significantly because of the recovery of the reversible changes of optic nerve and cornea



Fig. 16 a, b Patient with severe ophthalmopathy after steroid therapy /a/ and 6 years after the operation /b/, without steroid therapy.

In all cases, except the 3 cases of unilateral disease, the operation was performed on both orbits in a single operation. After the operation, in different time intervals, in all patients the subjective symptoms are observed, as well as the changes of eyelids, conjunctiva and cornea, the degree of exophthalmos by Hertel, the function of extraocular muscles, i.e. diplopia by Hess-Lancaster test, intraocular pressure, the change in the disc, i.e. the changes in vision and field of vision, as well as the thickening and elongation of extraocular muscles by CT or MRI scan and echography.

RESULTS

Using described method of orbital decompression all symptoms and manifestations of TO disappeared or significantly decreased. Although the results are evident immediately after operation, the definitive results were obtained until 2-3 months thereafter. The complete comparison of preoperative and postoperative results was conducted in 65 patients three months after operation. Postoperatively, in all patients subjective symptoms are considerably reduced or have disappeared. The swelling and deformities of the eyelids disappeared or was significantly reduced. Due to unsatisfactory correction of the upper eyelid retraction it was necessary to perform lengthening of the upper eyelid in four patients and correction of lower eyelid deformity in three patients. Conjunctival hyperemia and chemosis, as well as exposure keratitis resolved in all patients. All patients showed a significant reduction of exophthalmos / 5-11 mm, 7,2 mm on average / with marked improvement or normalization of ocular muscles function / Fig.1 – 16, Table 1,2 /. There were no cases of subsequent impairment of ocular motility, diplopia and strabismus. Due to unsatisfactory correction of double vision, strabismus surgery is performed in six patients. Out of 129 TO orbits in which decompression was performed, there was impairment of vision in 67 eyes due to optic neuropathy or/and due to corneal change. After the operation, the majority of these patients / 68% / showed improvement of vision and improvement or elimination of the field defect / Table 3 /. In all patients with partial atrophy of disc and irreversible changes in the cornea, there was no improvement of vision. In only one patient subsequent unilateral impairment of vision occurred. The intraocular pressure, measured by mmHg, before operation was 12-30, mostly 23-27, average 22. After the operation the pressure was 15-25, mostly 12-19, average 15. Until now, less evident relapse was recorded in only 3 cases out of total patients group and in only one patient was unilateral reoperation required. Echography, CT, and MRI scans showed great reduction of extraocular muscle thickening and shortening of the retrobulbar cone in all operated patients. Finally, significant aesthetic improvement has been achieved in all patients / Fig.1-16 /.

Complications: The majority of patients had transient hypoesthesia or anaesthesia of the infraorbital region. In one patient there was unilateral loss of vision a week after the operation. The ophthalmological conclusion was that the reason was the embolism of the central artery of retina. One patient, with chronic rhinitis, had meningitis with good therapeutic results. One patient had the nasal CSF with spontaneous disappearance during one week.

DISCUSSION

Significant symmetrical decompression, particularly in the narrow orbital apex, where is the highest pressure and main problem, is achieved by the surgical treatment described. The elimination of this pressure is necessary for normalization of the function of the orbital structures, especially of the function of the optic nerve and extraocular muscles. In addition, if the eyelid swelling, retraction and deformities are corrected, all signs and manifestations of TO will disappear or will be significantly decreased. If it is performed with precision, this procedure is without high risk.

It should be noted that there is no excuse for further applications of conservative treatment which does not give satisfactory results. The irreversible changes of optic nerve, cornea and extraocular muscles, i.e. disc atrophy, ulceration of cornea and extraocular muscles fibrosis, should be avoided. If disc atrophy has developed, no improvement in vision can be achieved by orbital decompression. If extraocular muscles fibrosis has occurred, neither exophthalmos nor diplopia and strabismus can be corrected satisfactorily by orbital decompression.

The main effect of decompression is achieved by widening of the orbit, i.e. by the removal of orbital walls, especially in its narrow apical region. Removal of orbital fat, without the removal of part of the orbital walls /1/ cannot produce satisfactory decompression in cases with marked TO. In certain patients with more evident exophthalmos, the orbital fat is atrophic, degenerated, so the removal of this small amount of the fat does not give a significant decompression and results. In some patients, with asymmetric exophthalmos, there is a smaller amount of fat on the side with more evident exophthalmos than on the other side. So, the main cause of exophthalmos are swollen, elongated extraocular muscles / 2-5 /. If this would not be so, numerous of the patients with severe TO would have enophthalmos. If this is correct, it is not correct statement that the removal of 1cc of orbital fat means the reduction of exophthalmos of 1mm. If it would be so, by removal of such amount of orbital fat, reduction of exophthalmos would not be significant. Regardless of that, it is necessary to remove orbital fat, i.e. sick tissue, as much as possible. If TO is autoimmune disease, it is possible that main or important autoimmune process occurs in orbital fat.

It has been frequently stated that orbital decompression does not usually improve extraocular muscles function and that after operation, there is often a deterioration of extraocular muscle function. Waller et al. / 6/ claim that decompression does not, as a rule, improve muscle function and that muscle dysfunction and diplopia were more apparent after the operation in the majority of cases, and that nearly 70% of their total group of patients required one or more strabismus operations after orbital decompression. Shorr et al. /7/ state that they had 34% incidence of worsened muscle balance after orbital decompression. Similar statement have been made De Santo /8/. Garrity et al. /9/ state that after transantral orbital decompression in 428 patients, "postoperatively new diplopia developed in 74 / 64% / of 116 patients who had no diplopia before orbital decompression, although 300 patients ultimately had strabismus surgery". Adenis et al. /10/ reported that all patients with moderate or severe diplopia remained with diplopia after fat removal orbital decompression and that in 32% operated patients developed

a new diplopia. Russo and al. /11/ state that, after 3-wall orbital decompression, in 18% of patients with diplopia there was no modification of diplopia and that in 23,5% of patients a more severe imbalance occurred. Kasperbauer and Hinkley /12/ reported that only 25% of their patients "did not require eye muscle surgery" after endoscopic decompression of the orbit. Etc, etc...

What is the cause of non-improvement and deterioration of extraocular muscle function after orbital decompression? The main cause, beside fibrosis of muscles, is the inadequate and insufficient orbital decompression. TO is complex pathological condition with serious pathological changes of all tissues of the orbital contents and the eyelids. Decompression of the orbit has numerous important details. Even, one inadequate performed detail can be cause of poor postoperative results, especially regarding diplopia and strabismus.

The majority of those who emphasize the poor function of extraocular muscle function after decompression of the orbit, performed this operation via transantral or endoscopic approach. Applying transantral approach, due to poor visibility in the course of the operation, it is possible to injure the extraocular muscles and cause a worsening of their function. If anterior, bulbar part of orbital floor or its large part is removed, by any approach, the globe loses its support and drops toward the sinus / Fig. 14 / causing marked diplopia and strabismus. Moreover, if the operation is performed in such way, the pressure in the orbital apex remains, i.e. a sufficient decompression effect, which would enable improvement in optic nerve and extraocular muscle function, is not achieved. In general, if the pressure in the orbital apex is not eliminated, a considerable improvement in extraocular muscles function and optic nerve function cannot be expected. Also, removal of orbital fat contributes to the decrease in pressure in the orbit and the improvement in optic nerve function and extraocular muscles function.

In the majority of up-to-now applied methods of orbital decompression, the orbital floor is frequently removed or orbital floor in conjugation with medial and/or lateral orbital wall. Leone et al /13/ recommended medial and lateral wall decompression with removal of the lateral orbital rim. They claim that the removal of the orbital floor causes postoperative complications "involving extraocular muscle imbalance, infraorbital anaesthesia, hypo-ophthalmia and recurrent sinusitis". Decompression of the lateral wall of the orbit produces a relatively small effect. Removal of the lateral orbital rim does not lead decompression of extraocular muscles and optic nerve in apical region of the orbit, but there is always a visible deformity. If only posterior, retrobulbar part of orbital floor is removed, it is practically impossible to produce hypo-ophthalmia. If orbital decompression is performed with precision, residual diplopia is the consequence of the initial disease process and not of the operation. The same will occur by decompression of only the medial and lateral walls if the preoperative exophthalmos was marked with diplopia. In such cases, there be more frequent residual diplopia because of insufficient decompression. If the surgery is performed carefully it is quite possible to avoid injury of the infraorbital nerve. After decompression of the orbital floor, if the sinus mucosa is injured, the sinus will be filled with blood. Blood clots in the sinus will be eliminated spontaneously through the natural ostium as happen after

facial bone injuries and orthognathic surgery. None of the patients from the group presented has had sinusitis so far. Thus, there is no reason to avoid decompression of orbital floor, i.e. removal of retrobulbar, posterior part. Without this procedure it is impossible to achieve adequate decompression of the orbit, especially of orbital apex, and it is mostly impossible, with marked TO, to get good functional and aesthetic results.

If only the lateral part of the orbital floor is removed, using Bartelena /14/ and Krastinova /15/ methods, it is equally impossible to achieve good orbital decompression since the medial part of orbital floor /medially from infraorbital nerve/ is considerably larger than the lateral part.

In some cases, in order to perform orbital enlargement and better correction of exophthalmos, Krastinova et al. /15/ insert the calvarial bone transplants on the lateral and superior orbital rim and the nasal bone. The mentioned enlargement of orbit makes AP diameter of the orbit longer. Longer diameter of the orbit makes stronger pressure in apical region of the orbit what is certainly unfavorable for further course of disease and diplopia.

Apart from decompression in the medial orbital wall, Pearl et al./16/ perform osteotomy of part of the lateral and lower orbital wall in the anterior part and the whole bony segment is rotated laterally. It is true that by applying this procedure the orbit is widening in anterior part and its volume is increased, but this procedure gives a poor decompression effect on the orbital apex where the main problem lies. Similarly, orbital expansion by Tessier /17/ and Wolfe /18/, along with the visible face deformity, does not give satisfactory decompression in the orbital apex.

Though lateral decompression gives the least effect of decompression, in all the cases of decompression through the floor and medial wall, decompression through lateral wall should also be performed. Lateral decompression, in addition, prevents superfluous medial globe displacement which can be also cause worsening of diplopia and strabismus.

The openings made in all orbital walls should be continuous, without bone bridge between the walls, as well as in the region of infraorbital nerve. In this way an important symmetrical decompression is achieved which enables the recovery of the all orbital structures and balanced decompression, i.e. the recovery of the extraocular muscles. Unbalanced recovery of the extraocular muscle can worsen diplopia and strabismus.

It is difficult to believe that four- wall decompression /19/ has a significantly greater decompression effect in comparison with three-wall decompression, considering that dura, i.e. the brain, lies against the opening in the orbital roof and could be cause of a pulsate eye or pulsate exophthalmos /Fig. 9 /. Also, it is difficult to believe that this method can produce the globe retrodisplacement up to 16 mm /19, 20 /, i.e. up to 17 mm /7 /. Globe retrodisplacement depends not only on bony openings, i.e. increased orbital volume, but, also, on the amount of periosteal openings and condition of orbital tissues, especially of the condition of extraocular muscles.

In order to obtain the functional as the aesthetic effect of decompression, even in severe cases of TO, it is enough to achieve globe retrodisplacement ranging 7 to 9 mm which can be done using the method described. Globe retrodis-

placement of 16 and 17 mm almost always leads to marked exophthalmos and malposition of the eyes with strabismus and diplopia.

Antral-ethmoidal decompression / 21,22,23/ and all other previously used methods / 24,25,26,27/ are archaic methods because of poor visibility during operation and poor results.

Endoscopic transnasal or transantral orbital decompression is less traumatic procedure than classic surgical methods of orbital decompression. But, with this technique it is impossible to perform wide three-walls decompression and the removal of significant amount of sick orbital fat, i. e. it is mainly impossible to achieve good results in cases of the marked TO. After the endoscopic decompression of the orbit the patient have often a worsening of diplopia and strabismus. The transconjunctival decompression has the similar disadvantages as the endoscopic decompression.

Strabismus operations should not be performed before orbital decompression. If orbital decompression is not performed before strabismus operation, the later will only lead to temporary improvement in extraocular muscles function, because it does not solve basic cause of muscle changes. Strabismus surgery should not be performed during the decompression of the orbit as well because of a real possibility of spontaneous recovery of the function of the extraocular muscles after the decompression. If spontaneous recovery, supported by exercises of eye movements, does not occur three months after the operation, a strabismus operation is indicated.

The first day after orbital decompression, it is necessary to start with exercises of eye movements to prevent fibrosis, scar around extraocular muscles which can limit the function of the muscles.

The described method of orbital decompression is logical, based on an understanding of the pathology, is less hazardous, is relatively easy to perform, gives constantly good functional and aesthetic results and allows rapid recovery.

Table 1. Changes in exophthalmos 3 months after orbital decompression / n=129 /

Reduction in mm.	Number of eyes
5	11
6	24
7	48
8	29
9	11
10	4
11	2

Table 2. Diplopia before and 3 months after orbital decompression / n= 65 /

	Without diplopia	Diplopia on lateral gaze	Diplopia on straight gaze
Before surgery	17	33	15
After surgery	40	19	6

Table 3. Vision changes 3 months after orbital decompression / n=67 /

Improvement	46
Unchanged	21
Impairment	0/1

Apstrakt

Uvod: U slučajevima teških oblika tiroidne oftalmopatije, konzervativna terapija ne daje zadovoljavajuće rezultate. Zbog toga se danas često primenjuje hirurška terapija, dekomprezija orbite. Primjenjuju se različite metode dekomprezija orbite sa različitim rezultatima, zaključcima i kontroverzama.

Bolesnici i metod: Od kraja 1986. godine, u 112 bolesnika, sa teškim oblikom tiroidne oftalmopatije, primenjena je sopstvena metoda dekomprezije orbite na tri zida, kombinovana sa odstranjnjem periorbitalnog, intraorbitalnog i retrobulbarnog masnog tkiva kao i sa korekcijom retrakcije i deformacija očnih kapaka.

Rezultati: U svih bolesnika, posle operacije, postignuto je značajno smanjenje egzotalmusa / 5-11 mm, prosečno 7,2 mm /, korekcija retrakcije i deformacija očnih kapaka, poboljšanje vida, značajno smanjenje intraokularnog pritiska, značajno poboljšanje funkcije ekstraokularnih mišića kao i značajno smanjenje ili nestanak subjektivnih tegoba. Nije bilo slučajeva sa pogoršanjem vida ni oslabljenom funkcijom ekstraokularnih mišića. Zbog nedovoljne korekcije diplopije, u 6 bolesnika izvršena je strabizam operacija.

U 3 bolesnika pojavio se slabije izražen recidiv. Samo u jednog bolesnika trebalo je uraditi jednostranu korekciju. U svih bolesnika postignut je značajan estetski rezultat.

Zaključak: Primjenjeni metod dekomprezije očne duplje je logičan, baziran na poznavanju patologije bolesti, predstavlja relativno lakšu hiruršku proceduru, bez velikog rizika, daje konstatno vrlo dobre funkcionalne i estetske rezultate i omogućava brzi postoperativni oporavak.

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