https://doi.org/10.17816/OV15811

NEW ALGORITHM FOR PLANNING SUPERIOR TARSAL MUSCLE RESECTION FOR BLEPHAROPTOSIS: DESCRIPTION OF TECHNIQUE AND RESULTS

© *V.V. Potemkin*[1, 2], *E.V. Goltsman*[2]

[1] Pavlov First Saint Petersburg State Medical University, Saint Petersburg, Russia;

[2] City Multi-Field Hospital No. 2, Saint Petersburg, Russia

For citation: Potemkin VV, Goltsman EV. New algorithm for planning superior tarsal muscle resection for blepharoptosis: description of technique and results. *Ophthalmology Journal*. 2019;12(3):83-90. https://doi.org/10.17816/OV15811

Received: 12.07.2019 Revised: 15.08.2019 Accepted: 17.09.2019

✧ ***Background.*** Transconjunctival techniques for blepharoptosis correction are popular because of ease of implementation and good predictability. For a long time, the phenylephrine test remained the main factor influencing the choice of blepharoptosis correction method. Recently, more and more researches indicate the possibility of the superior tarsal muscle resection in patients with negative responses to the phenylephrine test. Authors have proposed and described a new modified technique for resection of the superior tarsal muscle, which can be used to correct blepharoptosis in patients with different responses to phenylephrine test.

✧ ***Materials and methods.*** The study included 2 groups of patients with mild to moderate blepharoptosis with levator muscle function 8 mm or more. The main group (75 patients, 103 eyelids) underwent a modified resection of the superior tarsal muscle, and in the comparison group (26 patients, 35 eyelids) an open sky resection of the superior tarsal muscle was performed. Surgery in the main group was planned according to the following algorithm. In positive and sufficient response to the test, $^2/_3$ of the superior tarsal muscle was resected. In case of positive but insufficient response to the phenylephrine test, subtotal superior tarsal muscle resection was performed. In case of negative or slightly positive result of phenylephrine test, an assessment of the white line motility was additionally performed intraoperatively. If the motility of the white line (in mm) was equal to the amount of ptosis, subtotal superior tarsal muscle resection was performed without resection of the superior tarsal plate. If the motility of the white line was less than desired amount of correction, then subtotal superior tarsal muscle resection was combined with tarsal plate resection to reach the desired amount of correction. The residual height of the tarsal plate was always left 5 mm or more. If superior tarsal plate was compromised or not high enough to perform desired amount of resection then white line was advanced to the tarsal plate.

✧ ***Results.*** The degree of ptosis, the result, the width of the palpebral fissure in the center, lateral and medial limbus, MRD 1 and MRD 2 did not significantly differ between the groups ($p > 0.05$). However, the frequency of hypo- and hypercorrections was significantly lower in the main group ($p < 0.05$).

✧ ***Conclusion.*** New algorithm of planning modified superior tarsal muscle resection gives an opportunity to use transconjuctival methods of blepharoptosis correction in cases of weak and negative phenylephrine test and to reduce the amount of hypo- and hypercorrections

✧ ***Keywords:*** blepharoptosis; resection of the superior tarsal muscle; transconjunctival techniques; keratopathy; pseudoexfoliative syndrome.

НОВЫЙ АЛГОРИТМ ПЛАНИРОВАНИЯ РЕЗЕКЦИИ ВЕРХНЕЙ ТАРЗАЛЬНОЙ МЫШЦЫ ПРИ БЛЕФАРОПТОЗЕ: ОПИСАНИЕ МЕТОДИКИ И РЕЗУЛЬТАТЫ

© *В.В. Потёмкин* [1, 2], *Е.В. Гольцман* [2]

[1] ФГБОУ ВО «Первый Санкт-Петербургский государственный медицинский университет им. академика И.П. Павлова» Минздрава России, Санкт-Петербург;
[2] СПбГУЗ «Городская многопрофильная больница № 2», Санкт-Петербург

Для цитирования: Потёмкин В.В., Гольцман Е.В. Новый алгоритм планирования резекции верхней тарзальной мышцы при блефароптозе: описание методики и результаты // Офтальмологические ведомости. – 2019. – Т. 12. – № 3. – С. 83–90. https://doi.org/10.17816/OV15811

Поступила: 12.07.2019 Одобрена: 15.08.2019 Принята: 17.09.2019

✧ ***Введение.*** Трансконъюнктивальные методики коррекции блефароптоза популярны благодаря простоте выполнения и хорошей предсказуемости. Долгое время основным фактором, влияющим на выбор метода коррекции блефароптозов, оставался фенилэфриновый тест. В последнее время всё в большем количестве работ сообщается о возможности выполнения резекции верхней тарзальной мышцы у пациентов и с отрицательными ответами на фенилэфриновый тест. Авторы предложили и описали новую модифицированную методику резекции верхней тарзальной мышцы, которая может быть использована для коррекции блефароптоза у пациентов с различными ответами на фенилэфриновый тест.

✧ ***Материалы и методы.*** Было сформировано две группы пациентов с блефароптозами слабой и умеренной степеней с функцией мышцы, поднимающей верхнее веко, 8 мм и более. Пациентам основной группы (75 пациентов, 103 века) была выполнена модифицированная резекция верхней тарзальной мышцы, а пациентам из группы сравнения (26 пациентов, 35 век) — резекция верхней тарзальной мышцы по типу «открытое небо». Сформулирован следующий алгоритм планирования модифицированной резекции верхней тарзальной мышцы. При положительном и достаточном ответе на фенилэфриновый тест выполняют резекцию $^2/_3$ верхней тарзальной мышцы. При положительном, но недостаточном ответе на фенилэфриновый тест выполняют субтотальную резекцию верхней тарзальной мышцы. При отрицательных и слабоположительных результатах фенилэфринового теста интраоперационно дополнительно оценивают подвижность белой линии. При подвижности белой линии (в мм), соответствующей ожидаемому результату, выполняют субтотальную резекцию верхней тарзальной мышцы без резекции верхней тарзальной пластинки. При подвижности белой линии меньше, чем ожидаемый результат, производят субтотальную резекцию верхней тарзальной мышцы в сочетании с резекцией тарзальной пластинки на недостающую величину при условии, что остаточная высота тарзальной пластинки будет не менее 5 мм. При отсутствии подвижности белой линии или невозможности резекции верхней тарзальной пластинки в необходимом объёме белую линию фиксируют к тарзальной пластинке.

✧ ***Результаты.*** Степень птоза, результат (степень подъема верхнего века), ширина глазной щели в центре, по латеральному и медиальному лимбам, MRD 1 и MRD 2 достоверно не отличались между группами ($p > 0,05$). Однако частота гипо- и гиперкоррекции была достоверно ниже в основной группе ($p < 0,05$).

✧ ***Заключение.*** Новый алгоритм планирования резекции верхней тарзальной мышцы позволяет расширить показания к данному вмешательству, а также сократить количество гипер- и гипокоррекции блефароптоза.

✧ ***Ключевые слова:*** блефароптоз, резекция верхней тарзальной мышцы, трансконъюнктивальные методики; кератопатия; псевдоэксфолиативный синдром.

INTRODUCTION

Surgical treatment of blepharoptosis remains a relevant issue for ophthalmic and plastic surgeons, despite the variety of methods for its correction. Among various methods of surgical treatment of blepharoptosis, three main fields can be highlighted: suspending-type surgeries, transconjunctival techniques involving the superior tarsal muscle (STM), and transcutaneous techniques involving the aponeurosis of the upper eyelid elevator muscle [1–5]. This article focuses on transconjunctival resection of the STM.

Until recently, the main indication for STM resection was the presence of moderate to mild blepharoptosis with good or normal function of the upper eyelid elevator muscle (UEEM), as well as a positive phenylephrine (PE) test [1, 4, 6, 7]. Recently, however, more researchers have indicated the possibility of performing different variants of STM resection in patients with negative ("−") and weakly positive ("+/−") responses to the PE test [8–11].

Determination of the extent of STM resection deserves special consideration. There are quite a large number of calculation algorithms. Putterman was one of the first to propose the STM resection algorithm. He believed that to achieve eyelid lift with instillation of 10% PE, 8.5 mm of the STM should be resected, and 1 mm of muscle resection should be added or subtracted for each 0.5 mm of hypo- or hypercorrection in the range of 6.5–9.5 mm [12]. According to Weinstein, for correction of 2 mm of blepharoptosis, it is necessary to excise the STM by 8 mm, and it is assumed that the ratio of these two values is 1:4 [13]. Dresner suggested excising 4 mm of the STM for correction of 1 mm of blepharoptosis, 6 mm for 1.5 mm of blepharoptosis, 8 mm for 2 mm of blepharoptosis, and 11–12 mm for blepharoptosis of ≥3 mm; in case of insufficient effect of the PE test, resection of the tarsal plate should be added [14]. According to the conclusion of Mercandetti et al., based on their own studies, the ratio of the amount of STM resection to the degree of desired correction is 3 : 1 [15]. The algorithm proposed by Perry et al. involves resection of 9 mm of the STM to achieve the same eyelid height as in the test with 10% PE, and with hypocorrection, resection is supplemented with excision of the tarsal plate at a ratio of 1 : 1, but not more than 3 mm to prevent upper eyelid instability [16]. The variety of STM resection algorithms is confirmed by the lack of a universal algorithm, and therefore the search for new algorithms remains relevant. Moreover, in our own studies, we determined that the STM length in patients with blepharoptosis ranged from 8 to 23 mm. In this regard, we do not consider it appropriate to use algorithms that are based on absolute values in millimeters and that do not take into account the initial length of the STM in a particular patient.

MATERIALS AND METHODS

The study included patients with various degrees of blepharoptosis with excellent or good UEEM function (8 mm or more). The exclusion criteria were myogenic or neurogenic blepharoptosis, traumatic blepharoptosis, or a history of surgery for the condition, UEEM function of 7 mm or less, and severe dry eye syndrome.

The main group consisted of patients admitted to the Microsurgical Ophthalmic Department No. 5 of the City Multi-Field Hospital No. 2 between November 2017 and August 2019. The group included 75 patients (103 eyelids): 35 men (46.7%) and 40 women (53.3%). The average age of the patients in the main group was 54.8 ± 12.8 years. It is worth noting that the main group included patients with various responses to the PE test. Thus, among 75 patients, 37 (50 eyelids) had a positive ("+") response and 38 (53 eyelids) had a negative ("−") or weakly positive ("+/−") response to the PE test. The patients in the main group underwent a modified STM resection proposed by the authors for correction of blepharoptosis.

The comparison group consisted of patients admitted to the Microsurgical Ophthalmic Department No. 5 of the City Multi-Field Hospital No. 2 between January 2016 and September 2017. The group included 26 patients (35 eyelids): 10 men (38.5%) and 16 women (61.5%). The average age was 54.9 ± 14.9 years. All patients in this group had a "+" response to the PE test (Table 1). In this group, a retrospective analysis of surgical correction of blepharoptosis was performed. The patients underwent standard open sky STM resection according to the technique proposed by Lake et al. and described below.

Table 1 / Таблица 1

Distribution of patients by gender and age within groups
Распределение пациентов по полу и возрасту в пределах групп

Indicator		Main group	Comparison group	Significance in general for the indicator "gender," *p*
Gender	Male	46.7 % (35)	38.5 % (10)	0.15
	Female	53.3 % (40)	61.5 % (16)	0.15
Age		54.8 ± 12.8	54.9 ± 14.9	0.51

The main parameters for assessing the surgical treatment of blepharoptosis were selected as the degree of ptosis, degree of upper eyelid elevation, width of the palpebral fissure in the center and along the lateral and medial limbus, MRD1, and MRD2. The MRD1 (marginal reflex distance) is the distance from the corneal reflex to the upper eyelid margin in the center at the primary position, and the MRD2 is the distance from the corneal reflex to the lower eyelid margin in the center at the primary position.

The main stages of the surgery did not differ between the groups and are presented below. The primary differences between the groups included various algorithms for calculating the extent of the surgery.

The skin was treated with an antiseptic solution. Traction suture was applied (vicryl 4.00) to the center of the upper eyelid at the ciliary margin (Fig. 1a). The upper eyelid was everted on a Desmarres eyelid retractor (Fig. 1b). The conjunctiva was cut off with the STM from the upper margin of the tarsal plate, and the STM was mobilized (Fig. 1c). The white line was isolated (Fig. 1d; only in the main group). The assessment of mobility was performed by traction for the center of the STM venter in patients with "–" or "+/–" responses to the PE test (Fig. 1e; only in the main group). A suture fixing the STM to the tarsal plate was applied (Fig. 1f), and the STM was resected (Fig. 1g). Fixation of the STM stump with a U-shaped suture (vicryl 6.0) to the tarsal plate margin was performed (Fig. 1e). A continuous suture fixing the conjunctiva to the tarsal plate was applied (Fig. 1h, *i*).

Algorithm for calculating the extent of surgery for modified resection of the superior tarsal muscle

The algorithm for determining the extent of surgery with modified STM resection is presented in Fig. 2 and described in detail below (patent application No. 2019127580 dated 30.08.2019).

In patients with "+" and a sufficient response to the PE test, two-thirds STM resection was performed. In patients with "+" but an insufficient response to the PE test, a subtotal STM resection was performed. In patients with "–" and "+/–" results of the PE

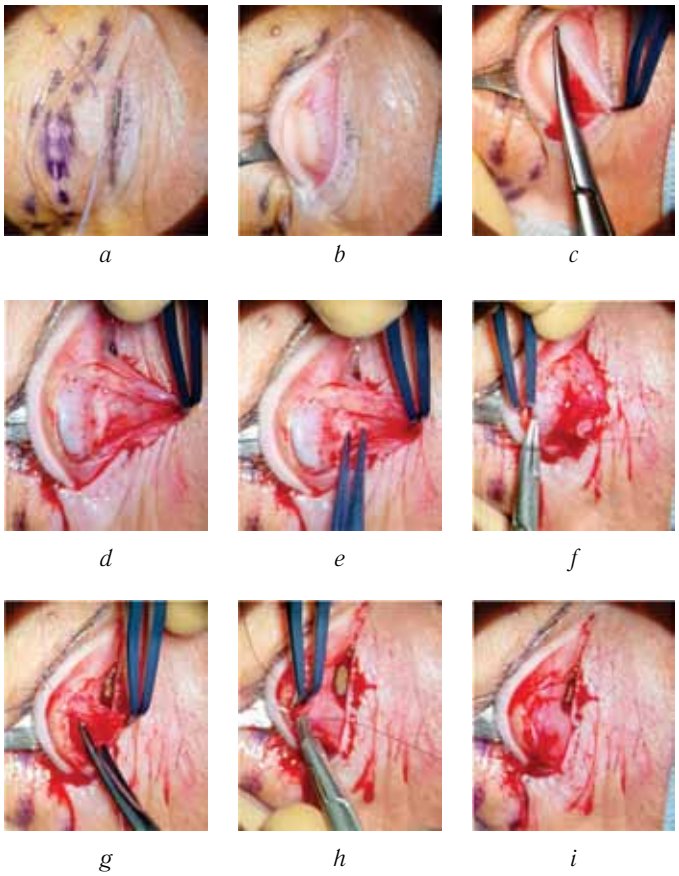

Fig. 1. Main stages of superior tarsal muscle resection (description in the text)

Рис. 1. Основные этапы резекции верхней тарзальной мышцы (описание в тексте)

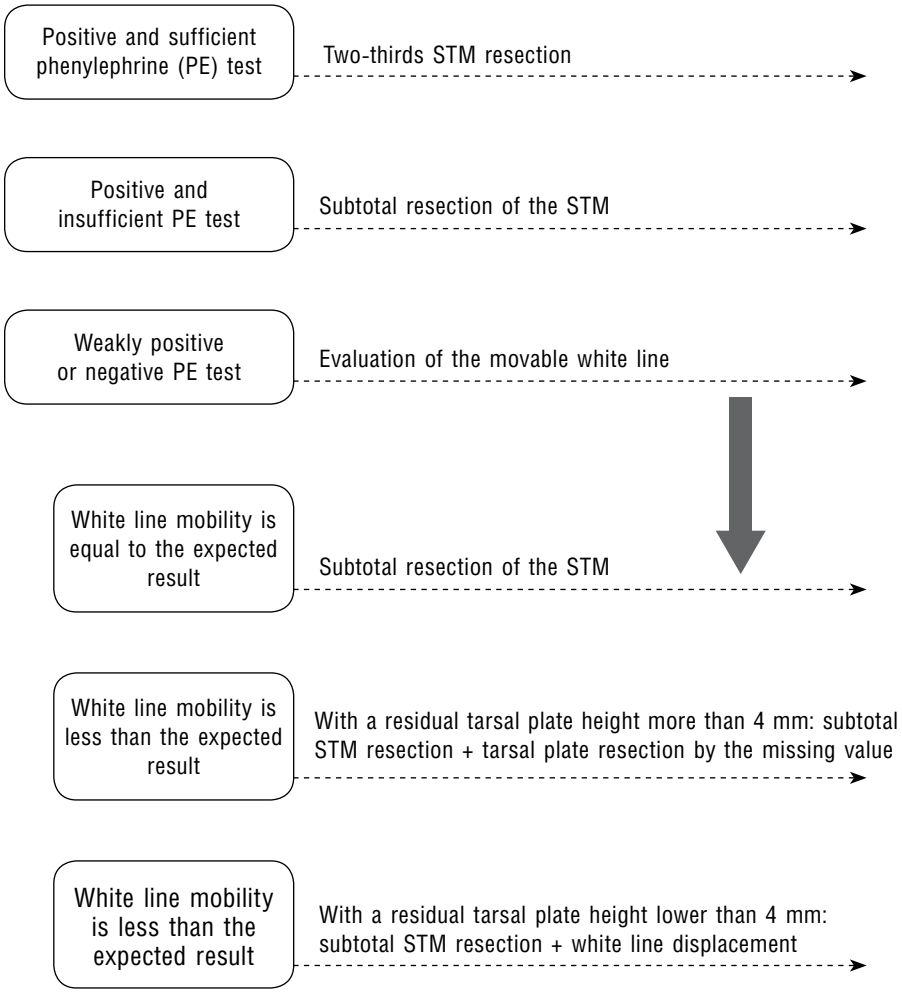

Fig. 2. Algorithm of modified superior tarsal muscle resection

Рис. 2. Алгоритм выполнения модифицированной резекции верхней тарзальной мышцы: ВТМ — верхняя тарзальная мышца, ФЭ-тест — фенилэфриновый тест

test, the mobility of the white line was additionally evaluated intraoperatively. When the mobility of the white line (in millimeters) corresponded to the expected result (the degree of upper eyelid elevation necessary for complete elimination of ptosis), subtotal STM resection was performed without resection of the upper tarsal plate. When the mobility of the white line was less than the expected result, subtotal STM resection was performed combined with resection of the tarsal plate by the missing value, provided that the residual height of the tarsal plate was at least 5 mm. If tarsal plate resection was not possible due to its height in the required extent, subtotal STM resection was performed in combination with white line displacement. In the absence of mobility of the white line, depending on the degree of ptosis, either the UEEM aponeurosis was resected or the white line was displaced to the tarsal plate.

Algorithm for calculating the extent of surgery of the standard open sky resection of the upper tarsal muscle (in the control group)

It is worth noting that all patients who underwent STM resection in this modification had a "+" response to the PE test. With a sufficient "+" response to the PE test, subtotal STM resection was performed or combined with resection of the tarsal plate by an amount required for the desired result.

Statistical analysis of the study results was performed using the Microsoft Excel 2010 application and the statistical program IBM SPSS Statistics 23 (IBM Corporation). When describing quantitative variables, the indicators were specified, namely the mean value and standard deviation. Normality testing was performed by the Shapiro–Wilk test. The ratio of quantitative variables in two independent groups was assessed by the Van

der Waerden test. The differences were considered statistically significant when $p < 0.05$.

RESULTS

The main parameters for evaluating the efficiency of modified STM resection were the degree of ptosis, the degree of eyelid elevation, the width of the palpebral fissure in the center and along the lateral and medial limbus, MRD1, and MRD2. All the parameters were evaluated before and 3 months after surgery. In the control group, a retrospective analysis of the results of surgical correction of blepharoptosis was performed. The results of surgical correction of blepharoptosis were compared between the main group and the comparison group.

Functional results in the late postoperative period were evaluated within the main group. All indicators were taken into account before and 3 months after surgery. The results are presented in Table 2.

The study showed that modified STM resection is an effective method to correct blepharoptosis in patients with various responses to the PE test, provided that the UEEM function is excellent or good. In intergroup comparison of the results, similar data were obtained in both groups, and no significant differences between the indicators were found (Table 3).

In addition to the above indicators, we compared the frequency of hypo- and hypercorrection between the groups and found that the frequency of hypo- and hypercorrection was significantly higher in the comparison group (Table 4). In our opinion, this was due to inaccuracy in calculating the extent of resection when planning surgical treatment.

Table 2 / Таблица 2

Results of modified superior tarsal muscle resection in the main group (Van der Waerden test)
Результаты модифицированной резекции верхней тарзальной мышцы в основной группе (критерий Ван-дер-Вардена)

Indicator	Before surgery	3 mo after surgery	Significance, *p*
Degree of ptosis	3.4 ± 0.9	0.09 ± 0.3	<0.0001
Width of the palpebral fissure in the center	5.6 ± 0.9	8.9 ± 0.4	<0.0001
Width of the palpebral fissure along the lateral limbus	4.2 ± 0.9	7.7 ± 0.6	<0.0001
Width of the palpebral fissure along the medial limbus	3.1 ± 0.8	6.6 ± 0.6	<0.0001
MRD1	0.6 ± 0.9	3.9 ± 0.4	<0.0001
MRD2	4.8 ± 0.4	5	0.17

Note. STM, superior tarsal muscle; MRD1, distance from the corneal reflex to the upper eyelid margin; MRD2, distance from the corneal reflex to the lower eyelid margin.

Table 3 / Таблица 3

Comparative analysis of the results between groups
Сравнительный анализ полученных результатов между группами

Indicator	Modified resection of the STM	Standard resection of the STM	Significance, *p*
Degree of ptosis	0.09 ± 0.3	0.12 ± 0.8	0.12
Width of the palpebral fissure in the center	8.9 ± 0.4	8.8 ± 0.8	0.2
Width of the palpebral fissure along the lateral limbus	7.7 ± 0.6	7.7 ± 0.8	0.88
Width of the palpebral fissure along the medial limbus	6.6 ± 0.6	6.6 ± 0.7	0.89
MRD1	3.9 ± 0.4	3.8 ± 0.9	0.2
MRD2	5	5	1
Result	2.6 ± 0.8	2.0 ± 0.6	0.035

Note. STM, superior tarsal muscle; MRD1, distance from the corneal reflex to the upper eyelid margin; MRD2, distance from the corneal reflex to the lower eyelid margin.

Table 4 / Таблица 4

The frequency of hypo- and hypercorrections in groups
Частота гипо- и гиперкоррекции в группах

Indicator	Modified resection of the STM	Standard resection of the STM	Significance, *p*
Hypocorrection	6.8% (7 eyelids)	17.1% (6 eyelids)	0.0001
Hypercorrection	0.97% (1 eyelid)	5.7% (2 eyelids)	0.0001

Note. STM, superior tarsal muscle.

DISCUSSION AND CONCLUSIONS

Interest in transconjunctival blepharoptosis correction techniques appeared in 1961, when data on STM resection were first published [5]. In 1975, Putterman and Urist introduced a new modification of STM resection, the essence of which consisted in isolated resection of the STM and conjunctiva without involvement of the tarsal plate [7]. It was believed for a long time that resection of the STM is only a form of resection of the UEEM aponeurosis. However, the results of histological studies have shown that the excised tissue is represented mainly by STM and conjunctiva [5]. The main advantages of transconjunctival techniques are the ease of implementation and predictability of the results.

To date, according to the literature, "–" and "+/–" responses to the PE test restrict the use of STM resection [1, 4, 6, 7]. Nevertheless, an increasing number of authors have reported good results after resection of the STM in patients with "+/–" and "–" responses to the PE test [8–11]. In our opinion, the indications for STM resection should be expanded, and the response to the PE test may not be the only factor to rely on when choosing a surgical correction technique.

The methodology of modified STM resection proposed by the authors and described above enables us not only to expand the indications for STM resection due to the possibility of its use in patients with "–" and "+/–" responses to the PE test, but also to calculate the extent of the required resection. Moreover, with the use of this method, the need for the most sparing resection of the tarsal plate can be determined.

The main distinguishing feature of the proposed technique is the assessment of white line mobility. The white line is a separate structure and is a transition zone between the transversostriated muscles of the UEEM and the STM smooth muscles. Assessment of white line mobility is an integral stage in the planning of modified STM resection in patients with "–" and "+/–" responses to the PE test.

Based on the foregoing, we can formulate the main indications for a modified STM resection:

- Congenital and acquired aponeurotic blepharoptosis of mild to moderate degrees with UEEM function of 8 mm or more;
- "+", "–", and "+/–" responses to the PE test.

In conclusion, studies of the possibility of using a modified technique of STM resection for acquired blepharoptosis of myogenic or neurogenic nature are ongoing. At present, this technique has been successfully used in two patients with Horner's syndrome. However, to expand the indications for this technique, it will be necessary to study the results of the proposed modification of STM resection in a larger sample of patients.

REFERENCES

1. Ben Simon GJ, Lee S, Schwarcz RM, et al. External levator advancement vs Müller's muscle-conjunctival resection for correction of upper eyelid involutional ptosis. *Am J Ophthalmol*. 2005;140(3):426-432. https://doi.org/10.1016/j.ajo.2005.03.033.
2. Blaskovics L. Treatment for ptosis: formation of a fold in the eyelid and resection of the levator and tarsus. *Arch Ophthalmol*. 1929;1(6):672-680. https://doi.org/10.1001/archopht.1929.00810010698002.
3. Custer PL. Ptosis: levator muscle surgery and frontalis suspension. In: Chen WP, eds. Oculoplastic surgery: the essentials. New York: Thieme; 2001. P. 89-100.
4. Finsterer J. Ptosis: causes, presentation, and management. *Aesthetic Plast Surg*. 2003;27(3):193-204. https://doi.org/10.1007/s00266-003-0127-5.
5. Fox SA. Surgery of ptosis. *Archives of Ophthalmology*. 1980; 98(1):186. https://doi.org/10.1001/archopht.1980.01020030188025.
6. Ben Simon GJ, Lee S, Schwarcz RM, et al. Müller's muscle-conjunctival resection for correction of upper eyelid ptosis: relationship between phenylephrine testing and the amount of tissue resected with final eyelid position. *Arch Facial Plast Surg*. 2007;9(6): 413-417. https://doi.org/10.1001/archfaci.9.6.413.

7. Putterman AM, Urist MJ. Müller muscle-conjunctiva resection. Technique for treatment of blepharoptosis. *Arch Ophthalmol*. 1975;93(8):619-623. https://doi.org/10.1001/archopht.1975.01010020595007.
8. Baldwin HC, Bhagey J, Khooshabeh R. Open sky Müller muscle-conjunctival resection in phenylephrine test-negative blepharoptosis patients. *Ophthalmic Plast Reconstr Surg*. 2005;21(4):276-280. https://doi.org/10.1097/01.iop.0000167789.39570.3e.
9. Lake S, Mohammad-Ali FH, Khooshabeh R. Open sky Müller's muscle-conjunctiva resection for ptosis surgery. *Eye (Lond).* 2003;17(9):1008-1012. https://doi.org/10.1038/sj.eye.6700623.
10. Peter NM, Khooshabeh R. Open-sky isolated subtotal Müller's muscle resection for ptosis surgery: a review of over 300 cases and assessment of long-term outcome. *Eye (Lond)*. 2013;27(4):519-524. https://doi.org/10.1038/eye.2012.303.
11. Malhotra R, Patel V. Transconjunctival blepharoptosis surgery: a review of posterior approach ptosis surgery and posterior approach white-line advancement. *Open Ophthalmol J.* 2010;4(1): 81-84. https://doi.org/10.2174/1874364101004010081.
12. Putterman AM, Fett DR. Müller's muscle in the treatment of upper eyelid ptosis: a ten-year study. *Ophthalmic Surg.* 1986;17(6): 354-360.
13. Weinstein GS, Buerger GF Jr. Modification of the Müller's muscle-conjunctival resection operation for blepharoptosis. *Am J Ophthalmol*. 1982;93(5):647-651. https://doi.org/10.1016/s0002-9394(14)77383-0.
14. Dresner SC. Further modifications of the Müller's muscle-conjunctival resection procedure for blepharoptosis. *Ophthalmic Plast Reconstr Surg*. 1991;7(2):114-122. https://doi.org/10.1097/00002341-199106000-00005.
15. Mercandetti M, Putterman AM, Cohen ME, et al. Internal levator advancement by Müller's muscle-conjunctival resection: technique and review. *Arch Facial Plast Surg.* 2001;3(2):104-110. https://doi.org/10.1001/archfaci.3.2.104.
16. Perry JD, Kadakia A, Foster JA. A new algorithm for ptosis repair using conjunctival Müllerectomy with or without tarsectomy. *Ophthalmic Plast Reconstr Surg.* 2002;18(6):426-429. https://doi.org/10.1097/00002341-200211000-00007.

Information about the authors

Vitaly V. Potyomkin — PhD, Assistant Professor. Department of Ophthalmology. Academician I.P. Pavlov First Saint Petersburg State Medical University; ophthalmologist. City Hospital No. 2, Saint Petersburg, Russia. E-mail: potem@inbox.ru.

Elena V. Goltsman — ophthalmologist. City Hospital No. 2, Saint Petersburg, Russia. E-mail: ageeva_elena@inbox.ru.

Сведения об авторах

Виталий Витальевич Потёмкин — канд. мед. наук, доцент кафедры офтальмологии. ФГБОУ ВО «ПСПбГМУ им. академика И.П. Павлова» Минздрава России; врач-офтальмолог. СПбГБУЗ «Городская многопрофильная больница № 2», Санкт-Петербург. E-mail: potem@inbox.ru.

Елена Владимировна Гольцман — врач-офтальмолог. СПбГБУЗ «Городская многопрофильная больница № 2», Санкт-Петербург. E-mail: ageeva_elena@inbox.ru.