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THE MAIN PROGNOSTIC FACTORS INFLUENCING THE RESULTS OF THE SUPERIOR TARSAL MUSCLE RESECTION IN PATIENTS WITH BLEPHAROPTOSIS

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✧ Transconjunctival methods of ptosis correction gain popularity nowadays. The wide use of the technique is limited because of the lack of clear recommendations regarding the volume of the resection, especially in patients with negative phenylephrine test. ***Purpose.*** To assess the influence of main predictive factors on superior tarsal muscle (STM) resection result. ***Materials and methods.*** Patients were divided into two groups according to the result of phenylephrine test (PE). Patients with positive results were included in the first group, with negative and weak results – in the second group. All patients underwent STM resection according our new algorithm. ***Results.*** The result of STM resection was influenced by PE test and intraoperative white line motility test (WLM), but not by levator function and the amount of superior tarsal muscle resection. ***Conclusions.*** PE and WLM tests play main role in choosing a method for blepharoptosis correcting.

✧ ***Keywords:*** blepharoptosis; superior tarsal muscle resection; phenylephrine test.

ОСНОВНЫЕ ПРОГНОСТИЧЕСКИЕ ФАКТОРЫ ВЛИЯНИЯ НА РЕЗУЛЬТАТ РЕЗЕКЦИИ ВЕРХНЕЙ ТАРЗАЛЬНОЙ МЫШЦЫ У ПАЦИЕНТОВ С БЛЕФАРОПТОЗОМ

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✧ Трансконъюнктивальные методики коррекции птоза верхнего века приобретают всё большее распространение. Однако основной сдерживающий элемент для их широкого применения — это отсутствие чётких рекомендаций, касающихся объёмов операции, особенно у пациентов с отрицательными ответами на фенилэфриновый тест. ***Цель.*** Оценить влияние некоторых факторов на результат резекции верхней тарзальной мышцы (ВТМ). ***Материалы и методы.*** В рамках работы были обследованы 75 пациентов (103 века), которые поступили для хирургического лечения птоза. Фенилэфриновый (ФЭ) тест стал критерием, определяющим разделение пациентов на 2 группы. Пациенты с положительными результатами вошли в состав первой группы, а пациенты с отрицательными и слабоположительными — в состав второй группы. Всем пациентам была выполнена резекция ВТМ по типу «открытое небо», в некоторых

случаях в сочетании с резекцией верхней тарзальной пластинки. ***Результаты.*** ФЭ-тест и подвижность белой линии оказывают воздействие на результат резекции ВТМ, в то время как остальные факторы не оказывают. ***Выводы.*** При выборе способа коррекции блефароптоза важное значение имеют ФЭ-тест и подвижность белой линии.

✧ ***Ключевые слова:*** блефароптоз; резекция верхней тарзальной мышцы; фенилэфриновый тест.

INTRODUCTION

Blepharoptosis treatment of is one of the most controversial aspects of modern ophthalmic plastic surgery. This is due to the lack of clear recommendations for the choice of surgical correction method. When choosing a treatment method, most specialists pay attention to the main factors, namely, the levator palpebrae superioris (LPS) function and blepharoptosis degree. Thus, severe blepharoptosis and poor LPS function (≤4 mm) are an indication for surgery using a suspensory material [1–4]. However, as for superior tarsal muscle (STM) or LPS aponeurosis resection, the situation is ambiguous since both methods can be used for moderate or mild blepharoptosis and excellent or good LPS function.

The epoch of transconjunctival approaches in the surgical treatment of blepharoptosis began in 1961 (Fasanella–Servat surgery) [9–11]. During this period, the methodology was modified several times. One latest modification was proposed by Lake et al. in 2003 [7]. Many algorithms are used for calculating STM resection amount. The most commonly used ones are those proposed by J.D. Perry et al. [12], S.C. Dresner [8], and S. Lake et al. [7]. The authors of the article previously proposed a new algorithm for superior tarsal muscle resection, the main difference of which is an intraoperative assessment of white line mobility to determine the possibility of superior tarsal muscle resection and its amount in cases of negative and weakly positive responses to phenylephrine (PE) test [15]. Thus, the need for search of additional factors that could be used as predictors of the superior tarsal muscle resection results is beyond doubt [5, 6].

The aim of present study is to evaluate the effect of PE test, of white line (WL) mobility, resected STM length, and of LPS function on the results of transconjunctival STM resection in patients with mild and moderate blepharoptosis, provided that the LPS function is good or excellent.

MATERIALS AND METHODS

A total of 75 patients (103 eyelids) with mild and moderate blepharoptosis were examined, when admitted for surgical treatment to the ophthalmological department No. 5 of St. Petersburg City Multi-Field Hospital No. 2 from November 2017 to August 2019.

Patients with the following conditions were excluded from the study:

- severe blepharoptosis,
- blepharoptosis of a traumatic or neurogenic nature,
- blepharoptosis accompanied by poor or moderate function of the LPS (8 mm or less),
- history of trauma that led to blepharoptosis development,
- history of surgeries to repair blepharoptosis, as well as any surgeries requiring the blepharostat application, and
- a history of various anti-aging procedures (botulinum therapy, permanent makeup, false eyelashes, etc.).

The patients were divided into two groups based on their PE test results. The PE test was performed according to the standard technique [11, 19]: a 2.5% PE solution (Irifrin, Sentiss, Switzerland) was instilled into the superior conjunctival fornix twice with a 5-min interval [12]. Measurements of the MRD1 (Margin reflex distance 1, the distance from the center of the corneal light reflex to the upper eyelid margin in its middle in millimeters) index were performed before instillation and 5 min after the last phenylephrine's instillation. The PE test results were assessed as follows: if the differences in MRD1 before and after instillation of 2.5% PE were 0–0.5, 1–1.5, and ≥2 mm, the test was considered to be negative, weakly positive, and positive, respectively [14, 20].

Group 1 included patients with positive ("+") responses to the PE test (37 patients, 50 eyelids) and group 2 – with negative and weakly positive ("–" and "+/–") responses (38 patients, 53 eyelids). The average ages of patients in groups 1 and 2 were 62.6 ± 8.6 and 64.6 ± 7.8 years, respectively ($p = 0.52$). There were 37.8% of men and 62.2% of women in group 1, and 55.2% of men and 44.8% of women in group 2 ($p = 0.1$).

All patients underwent modified STM resection according to the previously proposed technique, presented below. The PE test, resected superior tarsal muscle length, white line mobility, and LPS function were the factors influencing the STM resection result.

Technique of STM modified resection

After treating the facial skin with an antiseptic solution, a traction suture (Vicryl 4.00) was placed in the upper eyelid middle. Then, the upper eyelid was turned inside out using the Desmarrres lid retractor (Fig. 1, *a*). After superior tarsal muscle hydrodissection with 1.0 mL of 0.9% isotonic sodium chloride solution (Fig. 1, *b*), the conjunctiva with STM was cut off from the upper edge of the tarsal plate, and the latter was mobilized bluntly (Fig. 1, *c* and *d*). The next stage was the assessment of STM length and of white line mobility.

Method for assessing STM length

After isolation of the STM, its length in the middle was measured using a surgical caliper (Fig. 2).

Method for assessing white line mobility

After isolating the white line, its mobility was assessed using a surgical caliper by pulling the center of the STM myogaster along the line of the muscle fibers until displacement cessation (Fig. 3).

Then, the planned amount of the STM was resected (Fig. 4, *e*). The STM stump was fixed with a U-shaped suture (Vicryl 6.0) to the edge of the tarsal plate (Fig. 4, *f*). The surgery ended after the placement of a running suture fixing the conjunctiva to the tarsal plate without bringing the suture out (Vicryl 6.0; Fig. 4, *g*). Considering that the suture material is absorbable, suture removal was not required.

The LPS function was assessed at the preoperative stage by the amplitude of the upper eyelid movement

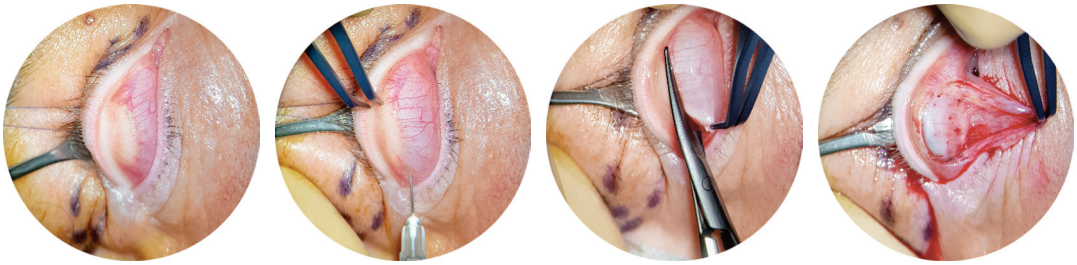


Fig. 1. Stages of modified superior tarsal muscle resection (*a*–*d*)

Рис. 1. Этапы модифицированной резекции верхней тарзальной мышцы: *a*–*d* см. в тексте

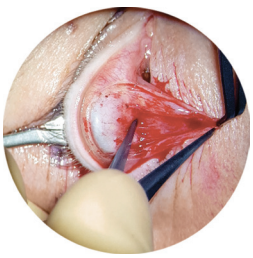


Fig. 2. Measurement of length of superior tarsal muscle resection

Рис. 2. Измерение длины резекции верхней тарзальной мышцы

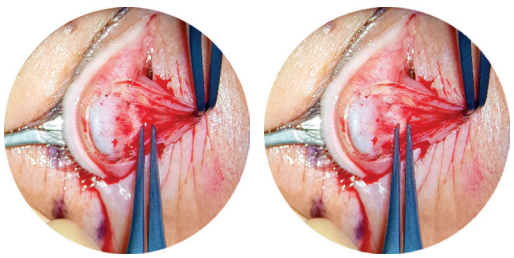


Fig. 3. Assessment of mobility of white line

Рис. 3. Оценка подвижности белой линии

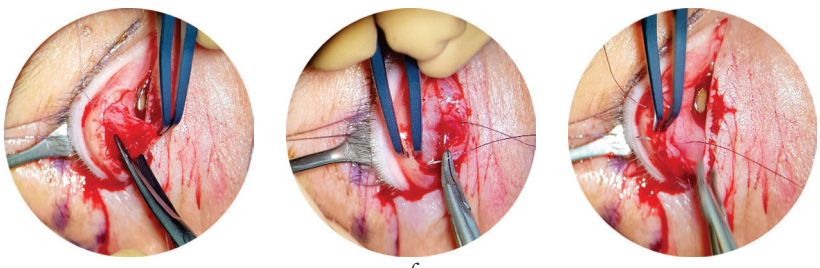


Fig. 4. Stages of modified superior tarsal muscle resection

Рис. 4. Этапы модифицированной резекции верхней тарзальной мышцы (продолжение рисунка 1)

(mm) when its position was changed from bottom to top, provided that the eyebrow was fixed.

Statistical analysis was performed using the IBM SPSS Statistics 23 software. The mean values and mean-square deviations of quantitative indices were calculated. To assess the linear relationships between the parameters, correlation analysis (Spearman's rank correlation) was performed.

RESULTS

Before proceeding to the result analysis, it is worth considering two concepts, namely, the results of the surgery as a whole and of the STM resection, in view of the fact that within the present study, the issue is the assessment of factors influencing the STM resection result. This concerns cases when STM resection was supplemented with tarsal plate resection. In these cases, to calculate the surgery result, the amount of the tarsal plate resection (mm) was subtracted from the result obtained (mm). Within the present study, the result was assessed 6 months after surgery. Thus, the STM resection results were 2.74 ± 1.0 mm in the group with positive PE test responses, and 2.46 ± 0.66 mm in the group with negative and weakly positive PE test responses ($p = 0.098$). The data obtained are presented in Table 1.

The PE test data amounted to 2.18 ± 2.3 mm in the group with "+" responses, and 0.6 ± 0.5 mm in the group with "–" and "+/–" responses ($p < 0.0001$). There was a moderate correlation of results between the surgical correction and PE test in the groups, according to the Chaddock scale ($R = 0.31$, $p = 0.03$ and $R = 0.33$, $p = 0.018$, respectively; Table 1).

The LPS function was 13.4 ± 2.0 mm in group 1 and 13.6 ± 1.7 mm in group 2 ($p = 0.61$; Table). None of the groups revealed a dependence of the STM resection result on LPS function ($R = 0.042$, $p = 0.77$ in group 1 and $R = 0.15$, $p = 0.274$ in group 2).

The resected STM amounts were 12.8 ± 3.4 and 12.6 ± 2.6 mm in groups 1 and 2, respectively ($p = 0.35$). In none of the groups, the resected STM amount affected the surgical outcome ($R = -0.01$, $p = 0.945$ in group 1 and $R = -0.24$, $p = 0.081$ in group 2; Table).

The white line mobility was 1.78 ± 1.0 mm in group 1 and 2.0 ± 0.7 mm in group 2 ($p = 0.56$; Table). In group 2, a significant high dependence of the STM resection result on white line mobility was revealed ($R = 0.02$, $p = 0.99$ in group 1 and $R = 0.72$, $p = 0.0005$ in group 2).

To illustrate the performance of STM resection in patients with negative PE test results, a clinical example is presented (Fig. 5). Patient N., female, 75 years old, complained of blepharoptosis on the left eye (Fig. 5, *a*). Clinical findings: the palpebral fissure width in the center was 5 mm, blepharoptosis degree 3 mm, LPS function 14 mm, and PE test 0 mm (negative; Fig. 5, *c*). Intraoperatively: white line mobility was 3 mm and STM length 19 mm (Fig. 5, *c*). The patient underwent subtotal STM resection. Thus, complete elimination of blepharoptosis was achieved, and the result of the surgery was 3 mm (Fig. 5, *d*).

DISCUSSION

PE test has long been the main factor considered by surgeons when choosing a method for surgical treatment of blepharoptosis. The test became widely known in 1979, thanks to R.K. Dortzbach who described in his work the possibility of using PE to assess the feasibility of STM resection [15]. An increasing number of authors agree that STM resection can be performed in patients with different PE test responses [7, 16, 17].

Distribution of received data in groups
Распределение полученных данных в группах

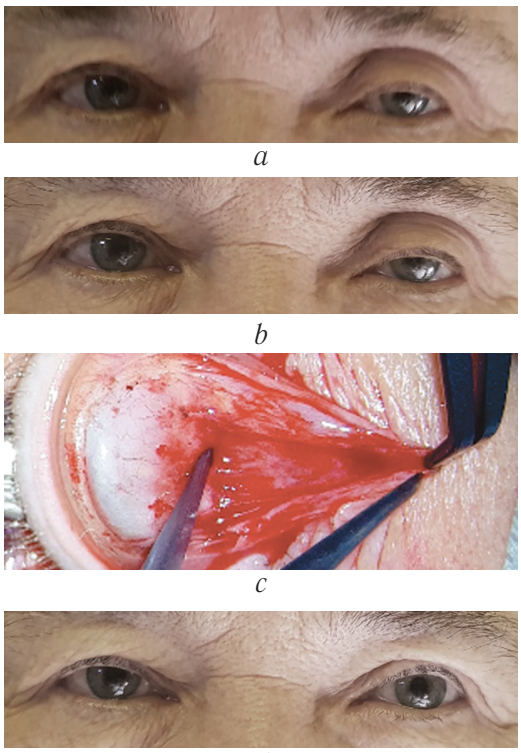
Parameters	Groups		Significance, *p*
	with "+" responses to phenylephrine test, *n* = 50	with "+/–" and "–" responses to phenylephrine test, *n* = 53	
Ptosis degree before surgery, mm	3.3 ± 0.9	3.5 ± 0.8	0.19
Result of STM resection, mm	2.74 ± 1.0	2.46 ± 0.66	0.098
Phenylephrine test, mm	2.18 ± 0.18	0.6 ± 0.5	<0.0001
LPS function, mm	13.4 ± 2.0	13.6 ± 1.7	0.61
Amount of STM resected, mm	12.8 ± 3.4	12.6 ± 2.6	0.35
White line mobility, mm	1.78 ± 1.0	2.0 ± 0.7	0.56

Note. *n*, number of eyelids; STM, superior tarsal muscle; LPS, levator palpebrae superioris.

Due to the widespread use of PE test, we decided to evaluate the dependence of STM resection primarily on its result. The data obtained indicate a moderate relationship according to the Chaddock scale in both groups ($R = 0.31$, $p = 0.03$ in group 1 and $R = 0.33$, $p = 0.018$ in group 2). This suggests that PE test must be used when deciding on the feasibility of STM resection, but only if other factors are considered.

The resected STM amount and LPS function do not influence the STM resection result.

The "white line" concept was introduced into our practice not long ago by E.A. Vanderson et al. [18], who, in their studies, demonstrated, both macroscopically and histologically, that this zone is a transition from LPS striated muscle fibers to STM smooth muscle fibers. According to our data, the assessment of white line mobility had no effect on the STM resection result in group 1, whereas a significant high dependence was revealed in group 2 ($R = 0.02$, $p = 0.99$, and $R = 0.72$, $p = 0.0005$, respectively). Thus, white line mobility has to be studied in cases of negative and weakly positive responses to PE tests. Moreover, this indicator may be the main factor determining the possibility of STM resection in this patient category.



a

b

c

d

Fig. 5. Example of modified Muller muscle conjunctival resection in patient with negative phenylephrine test: *a* — before test; *b* — after test; *c* — intraoperative superior tarsal muscle length measurement, *d* — after surgical correction

Рис. 5. Пример модифицированной резекции верхней тарзальной мышцы у пациента с отрицательным фенилэфриновым тестом: *a* — до теста; *b* — после теста; *c* — интраоперационное измерение длины верхней тарзальной мышцы; *d* — после хирургического лечения

CONCLUSION

The decision on the choice of a particular technique for correcting blepharoptosis and its extent has to be made on the basis of a combination of factors such as the PE test result and the degree of white line mobility.

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