

WHITE LINE MOTILITY TEST IN TRANSCONJUNCTIVAL MUELLERECTOMY FOR BLEPHAROPTOSIS

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✦ **Introduction.** It is common knowledge that positive response to phenylephrine (PE) test remains the main indication for superior tarsal muscle (STM) resection for mild and moderate blepharoptosis. However, in recent times, there have been reports about possibility of STM resection in patients with weakly positive and negative responses to the PE test. However, the question remains open what a surgeon should focus on when planning STM resection in these cases? Authors have developed a test for assessing motility of the white line that could help to answer this question. **Materials and methods.** 75 patients (103 eyelids) operated for blepharoptosis with STM resection in Saint Petersburg City Hospital No. 2 from November 2017 until august 2019 were enrolled in the study. **Results.** We found no significant correlation between the result of white line motility test in patients with positive response to PE test and the effect of surgery, while in patients with weak and negative PE test results there was a strong correlation. **Conclusion.** The white line motility test could help to assess the desired amount of STM resection in patients with weak and negative phenylephrine test results.

✦ **Keywords:** blepharoptosis; superior tarsal muscle resection; phenylephrin test; white line motility.

ИНТРАОПЕРАЦИОННЫЙ ТЕСТ ОЦЕНКИ ПОДВИЖНОСТИ БЕЛОЙ ЛИНИИ ПРИ ТРАНСКОНЪЮНКТИВАЛЬНОЙ РЕЗЕКЦИИ ВЕРХНЕЙ ТАРЗАЛЬНОЙ МЫШЦЫ ПО ПОВОДУ БЛЕФАРОПТОЗА

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✦ **Введение.** Общеизвестно, что основным показанием к выполнению резекции верхней тарзальной мышцы (ВТМ) при блефароптозах слабой и средней степени является положительный ответ на фенилэфриновый (ФЭ) тест. Однако в последнее время появляются данные о возможности выполнения резекции ВТМ при слаболожительных и отрицательных ответах на ФЭ-тест. Тем не менее вопрос, на что стоит ориентироваться хирургу при планировании резекции ВТМ при подобных ответах на ФЭ-тест, остается открытым. Авторами был разработан тест оценки подвижности белой линии, который может помочь ответить на этот вопрос. **Материалы и методы.** В рамках работы были обследованы 75 пациентов (103 века), поступившие для хирургического лечения блефароптоза на офтальмологическое отделение № 5 СПбГБУЗ «Городская многопрофильная больница № 2» в период с ноября 2017 по август 2019 г. **Результаты.** У пациентов с положительными ответами на ФЭ-тест не выявлена значимая зависимость послеоперационного результата от подвижности белой линии, тогда как у пациентов с отрицательными и слаболожительными ответами выявлена значимая зависимость. **Заключение.** Тест оценки подвижности белой линии является ориентиром для

определения объёма резекции верхней тарзальной мышцы у пациентов с отрицательными и слабо-положительными ответами на ФЭ-тест.

✦ **Ключевые слова:** блефароптоз; резекция верхней тарзальной мышцы; фенилэфриновый тест; подвижность белой линии.

INTRODUCTION

Transconjunctival access became popular in blepharoptosis surgery during the 1960s and 1970s. At that time, the first data on superior tarsal muscle (STM) resection, also known as the Fasanella–Servat surgery, were published [1], and this method has since been modified many times. Interestingly, the authors who initially published this method mainly suggested the excision of the aponeurosis of the upper eyelid levator muscle together with the STM, cartilage, and conjunctiva. However, a histological examination revealed that only the STM and the conjunctiva were excised. Notably, Blaskovics performed one of the first modifications of upper eyelid levator muscle resection with transconjunctival access in 1923 [2]. Transconjunctival techniques occupy a niche in the field of blepharoptosis surgery because the methods produce predictable results, yield a natural contour of the upper eyelid with a lack of visible scarring on the skin, and are easily performed.

For many years, the result of a phenylephrine (PE) test was the only objective criterion of success when planning an upper STM resection. Basically, this test involves stimulating the sympathetically innervated STM with an α_2 -adrenergic agonist (phenylephrine) and estimating the distance from the corneal reflex to the center edge of the upper eyelid before and 5 min after the instillation of the drug [3, 4]. Therefore, a positive result of this test was one of the main indications for performing STM resection. Nevertheless, recent literature increasingly provided data regarding the possibility of performing STM resection in cases with weakly positive and negative

PE test results [5, 6]. However, the question which test should be used by surgeons when planning STM resection in such cases remains unresolved.

The STM is a sympathetically innervated smooth muscle that originates from the aponeurosis of the upper eyelid levator muscle. It is slightly anterior to the Whitnall ligament and attaches to the upper edge of the tarsal plate [7, 8]. Many aspects of the STM topographic anatomy are well known, in contrast to those of the transition zone of the aponeurosis of the upper eyelid levator muscle in the STM, which is called the white line. While studying the STM morphology in cadaveric orbits, Vanderson et al. noted the presence of a transition zone that differed not only at an objective examination, but also according to a histological examination. This zone represents the point of transition between the striated tissue of the upper eyelid levator muscle into the smooth tissue of the STM, wherein fibers intersect with the connective tissue [9]. In addition, some preparations revealed bridges of loose connective tissue that connected these two types of muscle tissue. No cartilage tissue was detected within the transition zone. Consequently, the presence of the white line as a full-fledged anatomical structure is beyond argument, as it has been proven by histological identification (Fig. 1).

In recent years, the literature has increasingly described various modifications of the STM resection technique together with displacement of the white line [6, 10, 11]. The participation of this zone in the upper eyelid levator muscle and STM complex is beyond any doubt. Here, we propose an intraoperative test to assess white line mobility and describe our findings in detail.

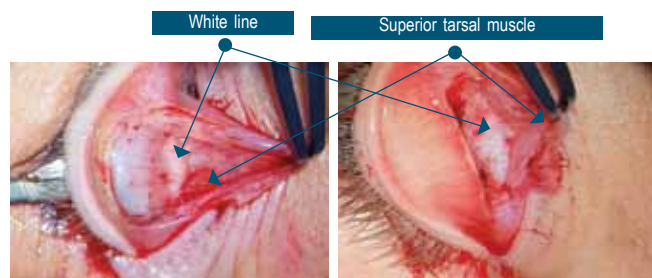


Fig. 1. White line

Рис. 1. Белая линия

MATERIALS AND METHODS

This study included 103 eyelids of 75 patients who were admitted to the Ophthalmology Department No. 5 of the St. Petersburg City Multi-field Hospital No. 2 for surgical treatment of ptosis between November 2017 and August 2019. All patients underwent an STM “open sky” resection, which was combined with superior tarsal plate resection in some cases. The exclusion criteria were traumatic

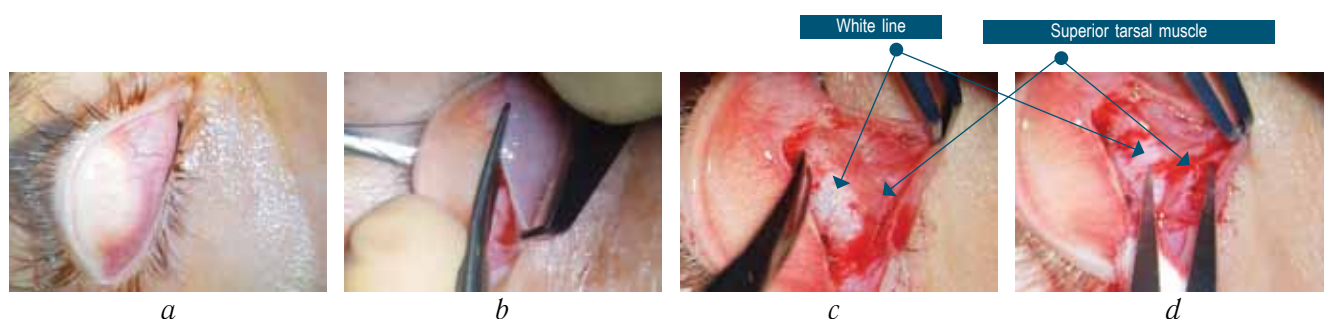


Fig. 2. White line motility test

Рис. 2. Интраоперационный тест оценки подвижности белой линии (описание в тексте)



Fig. 3. Example of 4 mm white line motility

Рис. 3. Пример подвижности белой линии 4 мм

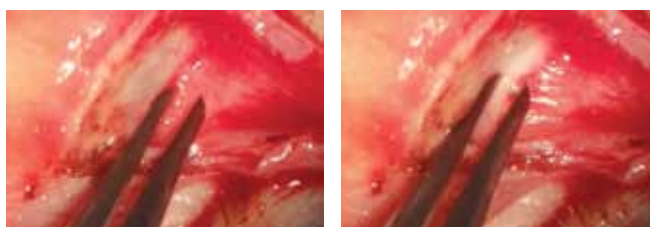


Fig. 4. Example of 1 mm white line motility

Рис. 4. Пример подвижности белой линии 1 мм

or neurogenic ptosis, ptosis with poor or moderate upper eyelid levator muscle function (≤ 8 mm) and a history of injury that affected the development of the upper eyelid ptosis or of previous surgeries to treat the condition.

The patients were divided into two groups. Group 1 comprised patients with positive responses to the PE test, while group 2 comprised those with negative and weakly positive responses.

All patients underwent STM resection, which was performed in combination with tarsal plate resection if necessary. All patients underwent an intraoperative white line motility assessment test.

The test was performed as follows. A traction suture was placed on the edge of the upper eyelid (Vycril 4/0). The upper eyelid was turned out using a Desmarres retractor (Fig. 2, *a*). The conjunctiva and STM were dissected from the upper edge of the tarsal plate (Fig. 2, *b*). The white line was identified, and its mobility was assessed by pulling the belly of the STM (Fig. 2, *c*, *d*). The volume of STM resection and possible excision of the upper eyelid tarsal plate were then planned according to the degree of white line mobility.

The white line mobility varied significantly from 0 to 4 mm in our cases (Fig. 3, 4).

Microsoft Excel 2010 (Microsoft Corp., Redmond, WA, USA) was used to compile the data tables. IBM SPSS Statistics 23 (IBM Corp., Armonk, NY, USA) was used to perform the statistical analysis. The normality of the data distribution was tested using the Shapiro–Wilk test. A correlation analysis based on the calculation of the Spearman correlation coefficient (r) was used to assess the linear relationships between the parameters.

RESULTS

In patients with positive responses to the PE test, an r of 0.02 was calculated for the correlation between white line mobility and the STM resection outcome (Cheddock scale: very weak attachment strength; $p = 0.99$).

In patients with weakly positive and negative responses to the PE test, an r of 0.72 was calculated for the correlation between white line mobility and the STM resection outcome (Cheddock scale: high attachment strength; $p = 0.0005$).

An r of 0.27 was calculated for the correlation between white line mobility and the STM resection outcome in all patients (weak attachment strength; $p = 0.005$). All data are presented in the Table.

Результаты корреляционного анализа

Results of correlation analysis

Indicator	Surgical treatment result, <i>r</i>	Significance, <i>p</i>
White line mobility in patients with positive responses to the phenylephrine test	0.02	0.99
White line mobility in patients with negative and weakly positive responses to the phenylephrine test	0.72	0.0005
Overall white line mobility	0.27	0.005

DISCUSSION

No single approach is used for STM resection. The development of many algorithms for STM resection emphasizes the lack of universal standardizations, which is accompanied by shortcomings. The most universal and popular algorithms are those proposed by Perry et al., Lake et al. and Dresner et al. [12-14].

The algorithm proposed by Perry et al. was based on the equivalence between the maximum stimulation of the STM with 10% phenylephrine and the resection of the STM by 9 mm. If the PE test fails to elicit a sufficient effect, the upper eyelid tarsal plate is resected at a ratio of 1 : 1; in other words, a 1-mm hypocorrection is equivalent to a 1-mm tarsal plate resection (maximum resection: 2.5 mm) [12]. For cases with insufficient responses to the PE test, Lake et al. proposed the performance of STM resection with the "open sky" modification in combination with a 1-mm cartilage resection, regardless of the extent of hypocorrection [13]. Dresner et al. suggested that only the STM should be resected according to the following scheme: 4-mm STM resection for 1 mm of ptosis, 6-mm resection for 1.5 mm of ptosis, 10-mm resection for 2 mm of ptosis and 11–12-mm resection for ≥3 mm of ptosis [14]. Notably, one study observed no relationship between the STM resection amount and the surgical outcome [15].

In our opinion, the determination of the indication and amount of STM resection in a patient with a negative or weakly positive response to the PE test remains the greatest unresolved problem. The test proposed herein was developed to solve this problem. Basically, this test assesses the strength of the attachment of the STM to the aponeurosis of the upper eyelid elevator muscle. The results of the test determine the indication and volume of STM resection in patients with weakly positive and negative responses to a 2.5% PE test. Based on the results from our assessment of the white line mobility test,

we can formulate an algorithm for the performance of STM resection in a patient with a weakly positive or negative PE test result. This algorithm can include the degree of STM and superior tarsal plate resection, if necessary.

CONCLUSION

The white line mobility assessment proposed in this work not only enables an expansion of the indications for performing STM resection in a patient with negative or weakly positive PE test results, but also enables a calculation of the magnitude of STM resection and an evaluation of the necessity for superior tarsal plate resection.

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