Posterior approach technique in mild ptosis repair

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Background: The success rates of conjunctiva-Müller muscle resection vary in reports of previous studies, with 81% to 88.6% success rates having been reported in other countries. Few studies have reported on the surgical success rates of conjunctiva-Müller muscle resection in Korea compared to the number of reports on other methods of blepharoptosis repair. We therefore sought to determine the clinical efficacy and success rate of conjunctiva-Müller muscle resection in patients with mild blepharoptosis and identify the factors that affect the surgical success rate.

Objective: This study was performed to evaluate of the clinical efficacy and success rate of conjunctiva-Müller muscle resection (posterior approach technique) in patients with mild blepharoptosis and to identify the factors that affect its surgical success rate.

Methods: Surgeries were performed by one surgeon in 30 patients (35 eyes) and only when the marginal reflex distance 1 (MRD1) increased over 1 mm at 5 minutes after the administration of 0.25% phenylephrine eye drops. The MRD1, MRD2, Brow-pupil distance (BPD), and interpalpebral fissure (IPF) were measured pre-operatively, 1 month post-operatively, and at the final follow-up visit.

Results: The mean MRD1 increased significantly from 0.83 ± 0.96 mm pre-operatively to 2.45 ± 0.77 mm post-operatively ($p=0.012$). The mean IPF also increased significantly from 5.54 ± 2.04 mm pre-operatively to 7.62 ± 1.85 mm post-operatively ($p=0.003$). The mean BPD, however, did not change significantly (22.94 ± 4.96 mm pre-operatively and 23.19 ± 5.72 mm post-operatively, $p=0.863$). The post-operative MRD1 for the eye with blepharoptosis was less than 1 mm compared to that for the opposite eye.

Conclusion: Conjunctiva-Müller muscle resection is a safe and effective surgical method in patients with mild or moderate blepharoptosis with good levator palpebrae muscle function in which the post-operative results can be predicted on the basis of the amount of muscle resection.

Keywords: blepharoptosis; conjunctiva-Müller muscle; levator palpebrae muscle; MRD1; surgical success

Introduction

Decisions to perform ptosis surgery depend on the cause and extent of blepharoptosis, and degree of levator palpebrae muscle function. The surgical methods for mild and moderate blepharoptosis include conjunctiva-Müller muscle resection and levator aponeurosis repair [1,2]. For mild blepharoptosis in particular, conjunctiva-Müller muscle resection is widely used because the tarsus is not removed, thus causing little damage to it and to the lacrimal gland, and the procedure is short and

yields relatively predictable results [3-6].

The success rates of conjunctiva-Müller muscle resection (posterior approach technique) vary in reports from different studies, and 81–88.6% success rates have been reported in other countries [5-7]. A limited number of studies have reported surgery success rates in Korea, a low number of studies compared to the number of reports on other methods of blepharoptosis repair: 83% by Bae et al. [8]; 87.5% by Ha et al. [9] involving surgery on 8 eyes of anophthalmia patients; and 93 % by Park et al. [10]. The objectives of our study were to determine the clinical ef-

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efficacy and success rate of conjunctiva-Müller muscle resection in patients with mild blepharoptosis and to identify factors that affect the surgical success rate.

Materials and methods

A retrospective review was conducted by comparing the medical records and images before and after surgery for 35 eyes of 30 patients who underwent conjunctiva-Müller muscle resection for mild-to-moderate blepharoptosis between January 2005 and March 2017.

All patients underwent levator palpebrae muscle function and phenylephrine testing, and the occurrence of Bell's phenomenon and marginal reflex distance 1 (MRD1) were assessed. Surgery was performed only when the MRD1 increased over 1 mm at 15 minutes after the administration of 0.25% phenylephrine eye drops. Fifteen minutes later, if the MRD1 was equal to that of the opposite eye, the length of resection was 8 mm. If it was less than that of the opposite eye, the length of resection was 9 mm. If it was greater than that of the opposite eye, the length of resection was 7 mm. All of the surgical procedures were performed by the same surgeon.

The surgical procedure involved local anesthesia with a mixture of 2% lidocaine and 1:100,000 epinephrine, followed by exposure of the upper eyelid with a Desmarres retractor. Calipers were used to mark the excision site with a surgical marking pen from the upper margin of the upper tarsus; then, two curved mosquito forceps were used to hold Müller's muscle and the conjunctiva between the upper margin of the upper tarsus and the marked site. Continuous sutures were placed using 6-0 nylon (ETHICON; J-1 Medical, Seoul, Korea) below the mosquito forceps. After suturing, the area between the suture site and

the mosquito forceps was resected with Westcott scissors. The average length of resection was 8 mm. Surgical success was defined as lid increase greater than 2 mm for unilateral ptosis surgery. For bilateral ptosis surgery, it was defined as a difference in MRD1 between the two eyes less than 1 mm, with a lid increase greater than 2 mm. Under-correction occurred when the MRD1 of the eye with ptosis was less than 1 mm compared to the MRD1 of the other eye; over-correction occurred when the MRD1 of the operated eye was greater than 1 mm compared to the other eye. The MRD1, MRD2, brow-pupil distance (BPD, between the center of pupil and the eyebrow vertically), and interpalpebral fissure (IPF) were measured pre-operatively, 1 month post-operatively, and at the final follow-up visit. The Image J program (NIH, Bethesda, MD, USA) was used to accurately evaluate images of operative sites (Fig. 1).

Statistical analysis was performed using IBM SPSS Statistics ver. 12.0 (SPSS Inc., Chicago, IL, USA). The MRD1, MRD2, BPD, and IPF before and after surgery were compared using paired t-tests. A p-value<0.05 was defined as an indicator of a statistically significant difference.

Results

The mean age of 30 patients (9 males and 21 females) was $51.0 \pm$ standard deviation of 11.6 years. The mean levator palpebrae muscle function measured using Berke's method was 10.22 ± 2.33 mm. The mean MRD1 increased significantly from 0.83 ± 0.96 mm pre-operatively to 2.45 ± 0.77 mm post-operatively ($p=0.002$). The mean IPF also increased significantly from 5.54 ± 2.04 mm to 7.62 ± 1.85 mm ($p=0.005$). The mean BPD, however, did not change significantly (22.94 ± 4.96 mm pre-operatively and 23.19 ± 5.72 mm post-operatively, $p=0.571$; Table 1). The post-operative MRD1 for the eye with blepharoptosis was a <1 mm difference from that of the opposite eye in 25 patients (83%; Fig. 2).

Following the pre-operative administration of phenylephrine, when the MRD1 was similar to that of the opposite eye, the

Fig. 1. Pre-operative and post-operative MRD1, IPF, and BPD are measured using Image J program. MRD1, marginal reflex distance; IPF, interpalpebral fissure; BPD, pupil to brow distance.

Table 1. Clinical outcomes of conjunctival mullerectomy

Variable	Preoperative (mm)	Postoperative (mm)	Difference (mm)	p-value
MRD1	0.83 ± 0.96	2.45 ± 0.77	1.62	0.002*
IPF	5.54 ± 2.04	7.62 ± 1.85	2.08	0.005*
BPD	22.94 ± 4.96	23.19 ± 5.72	0.20	0.571

Values are expressed as mean $\pm$ SD.

MRD1, marginal reflex distance; IPF, interpalpebral fissure; BPD, pupil to brow distance.

*Statistically significance is considered at $p < 0.05$. Paired t-test.

Fig. 2. Pre-operative (A) and post-operative (B) photographs of a patient with symmetrically corrected blepharoptosis.

surgical success rate was 90% (18 of 20 patients). When it was less than that of the opposite eye, the MRD1 was the same in 4 of 6 patients (a 67% surgical success rate). When the MRD1 was greater than that of the opposite eye, the surgical success rate was 75% (3 of 4 patients).

Under-correction, wherein the post-operative MRD1 of the eye with ptosis was less than that of the other eye by >1.0 mm, occurred in 4 patients (13%), and over-correction, wherein MRD1 was greater than that of the other eye, occurred in 1 patient (3.3%).

Discussion

Conjunctiva-Müller muscle resection is known as a safe and effective procedure in patients with mild-to-moderate ptosis with favorable levator palpebrae muscle function and pre-operative phenylephrine testing [11]. Weinstein and Buerger [6] reported an eyelid elevation of approximately 0.25 mm from a 1.0-mm conjunctiva-Müller muscle resection. Dresner [12] reported the same results; however, he also reported that a 10-mm resection in an eye with over 2 mm of ptosis resulted in an eyelid elevation of 3 mm, so a 1-mm resection is predicted to elevate the eyelid by approximately 0.3 mm. In addition, Mercandetti et al. [13] reported eyelid elevations of 1.92 mm with a 6-mm resection, 2.24 mm with a 7-mm resection, 2.56 mm with an 8-mm resection, and 3.20 mm with a 10-mm resection, and concluded that an eyelid elevation of 0.32 mm is expected for each 1-mm conjunctiva-Müller muscle resection. In Korea, Bae et al. [8] reported an eyelid elevation of 1.2 mm with a 7.0-mm resection, 1.4 mm with an 8.0 mm resection, and 1.8 mm with a 9.0 mm resection. Park et al. [10] reported a mean eyelid elevation of 1.47 mm with an 8.0-mm conjunctiva-Müller muscle resection. In contrast, Zauberman et al. [14] reported that the amount of Müller's muscle in resected tissues was not proportional to the degree of eyelid elevation. In the present

Table 2. Comparison of amounts of resection to amounts of elevation

Amount of elevation	Our results	Park et al. [10]	Dresner [12]	Mercandetti et al. [13]
8-mm resection (mm)	1.62	1.47	2.0	2.56

study, an 8.0-mm conjunctiva-Müller muscle resection resulted in an eyelid elevation of 1.62 mm on average, which is similar to the eyelid elevation of 1.47 mm following an 8.0-mm resection reported by Park et al. [10] (Table 2). The degree of eyelid elevation was less than in the studies conducted in other countries. Indeed, the same amount of conjunctiva-Müller muscle resection may result in less eyelid elevation in Asians due to the smaller palpebral fissure and dense fibrous anatomic features of the medial and lateral canthus compared to Westerners. The surgical success rate was 83%, suggesting that the degree of eyelid elevation was less for the same amount of resection because Korean patients have a smaller palpebral fissure and MRD1 compared to Westerners. The reasons for the smaller MRD1 in Koreans include well-developed thick orbicularis oculi muscles in Asians, which results in sagging skin below the upper eyelid, and abundant orbital fat and septum sagging close to the upper tarsus, resulting in a heavier upper eyelid that requires more force to lift the upper eyelid [15].

In agreement with Ben Simon et al. [5], there was no significant change in the BPD after a conjunctiva-Müller muscle resection in the present study. This finding is consistent with the results of Starck et al. [16] and Frankel and Kamer [17], who reported no change in eyebrow position after cosmetic blepharoplasties.

In conclusion, conjunctiva-Müller muscle resection is a safe and effective surgical method in patients with mild or moderate ptosis with good levator palpebrae muscle function in which the post-operative results can be predicted on the basis of the amount of muscle resection.

Conflicts of interest

The authors have nothing to disclose.

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