

# Clinical Effects of Conjunctiva-Müller Muscle Resection in Anophthalmic Ptosis

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**Purpose:** To evaluate the clinical effects of conjunctiva-Müller muscle resection through conjunctival incision in anophthalmic patients with mild ptosis.

**Methods:** Conjunctiva-Müller muscle resection was performed by one surgeon in 8 patients (8 eyes) who had received evisceration or enucleation and responded to 10% phenylephrine solution to correct ptosis. The average age of the patients was  $35.87 \pm 13.4$  years. Ptosis was seen from 1 to 34 months after evisceration or enucleation. The preoperative MRD 1 was -2 to 0.5 mm (average :  $-0.25 \pm 1.10$  mm) and the difference of MRD 1 between before and after 10% phenylephrine use was  $2.56 \pm 0.98$  mm. The Müller muscle was resected 7.5 to 9 mm through conjunctival incision during surgery to match the MRD 1 of sound eye. Mean follow-up period after the operation was 2 to 16 months (average : 8.1 months).

**Results:** Postoperatively, the MRD 1 increased by  $1.81 \pm 0.88$  mm on the average, corresponding to the improvement in lid elevation after the use of 10% phenylephrine performed before resection. Surgery was successful in most patients, and postoperative difference in MRD 1 was less than 1 mm from the sound eye. No special postoperative complication was observed.

**Conclusions:** Conjunctiva-Müller muscle resection is one of the effective methods of correcting mild ptosis in anophthalmic patients.

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**Key Words:** Anophthalmic ptosis, MRD 1, Müller muscle

Among those patients with ptosis, some patients are with a mild ptosis caused by the abnormal action of Müller muscle during levator elevation. The Müller muscle is an involuntary muscle controlled by the sympathetic nerve and ptosis can be seen when the function of this muscle decreases due to various causes. One of the causes is abnormal sympathetic nerve control such as in the case of ptosis in Horner's syndrome in which lid elevation can be seen after the use of a sympathetic agonist.<sup>1</sup> Conjunctiva-Müller muscle resection was first introduced by Putterman et al<sup>1</sup> in 1975 and is reported to be successful in patients responsive to sympathetic agonists. Furthermore, this method reduces instability in the upper tarsal plate and corneal irritation in comparison to Fasanella-Servat's method of resecting the tarsal plate.<sup>1,4</sup> Ptosis can develop due to evisceration in anophthalmic patients and due to damaged levator muscle and nerve, and transient ptosis develops due to edema after

surgery.<sup>2,3</sup> Thus, we performed conjunctiva-Müller muscle resection proposed by Putterman et al. to correct mild ptosis seen in anophthalmic patients who responded to 10% phenylephrine to examine whether ptosis could be corrected.

## Materials and Methods

Among those anophthalmic patients with ptosis who came to our department, conjunctiva-Müller muscle resection was performed in 8 patients (8 eyes) who showed lid elevation after using 10% phenylephrine hydrochloride. The patients included 4 males and 4 females. The average age of these 8 patients was  $35.87 \pm 13.4$  years. Written informed consent was obtained from each subject after explanation of the risks, benefits, and alternatives of the study. Conjunctiva-Müller muscle resection was performed at least 6 months after evisceration or enucleation in all patients and temporary ptosis seen before surgery was not included. The size and shape of the prosthesis was evaluated and an attempt was made to correct ptosis by modifying and refitting the prosthesis preoperatively. Before the procedure, the MRD 1 was measured in the ptotic eye and sound eye with the patient wearing the artificial eye. The MRD 1 was measured again at 5 minutes after the use of 10% phenylephrine

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solution. Ptosis became severe in 3 patients (3 eyes) due to deep superior sulcus. Thus, conjunctiva-Müller muscle resection was performed 6 months after augmentation using Medpor® sheet in these patients.

Surgery was performed under local anesthesia of subconjunctiva and subcutaneous layer using 2% lidocaine not containing epinephrine. The upper lid was everted using Desmarres retractor to expose the conjunctiva and superior portion of the upper tarsal plate. After marking the site 8 mm superior to the exposed margin of the upper tarsal plate using a marking pen, 10% phenylephrine solution was dropped into the eye. According to the degree of lid elevation, additional marking was done 8 mm superior to the exposed margin when no significant difference was present in lid elevation between the ptotic eye and sound eye, 9 mm superior when the lid was lower in the ptotic eye compared with the sound eye, and 7.5 mm superior when the lid was elevated more in the ptotic eye. Then, the conjunctiva and Müller muscle were clamped at the same time using two curved mosquito holders. After confirming that the levator aponeurosis was not included within the holders by pulling the skin with the forceps, continuous suture was done from the temporal side to the nasal side along the line 1 mm below the holders using 6-0 double armed nylon suture. Then, the holders were lifted and the conjunctiva and Müller muscle were excised at the same time using a number 15 blade. Pathologic examination was performed with the excised tissue specimen to confirm that the Müller muscle was resected. The lid was everted again using Desmarres retractor, and the margins of upper tarsal plate, Müller muscle and conjunctiva were sutured using 6-0 nylon suture by continuous pattern from the nasal side to temporal side. After excising the skin about 4 mm on the temporal side, the two suture needles were passed to the cutaneous side and tied. Then, the knot was placed subcutaneously and only antibiotic ointment was spread on the unsutured resection wound. A pressure eye patch was placed on the operated eye and removed one day after operation.

The operation site and the presence of hematoma were observed by postoperative 1 day. Through outpatient observation by postoperative 2 weeks, sutures were removed,

and the MRD 1 was measured in both eyes to determine the effect of lid elevation and the presence of complications. The lid elevation was considered to be successful in this study when the difference in MRD 1 was less than 1mm between both eyes in those patients who could be followed up for more than one month.<sup>2</sup>

## Results

The subjects included 4 males (4 eyes) and 4 females (4 eyes) whose average age was 35.87±13.4 years. The follow-up period was 2 to 16 months (average: 8.1 months). Ptosis was seen by 1 to 34 months after evisceration (3 eyes in 3 patients) or enucleation (5 eyes in 5 patients) (Table 1). Transient ptosis could be excluded since ptosis was seen for at least 6 months in all patients. Three patients (3 eyes) who showed significantly deep superior sulcus received augmentation using Medpor® sheet. However, significant ptosis was present after augmentation and the conjunctiva-Müller muscle resection was performed (Table 1). The MRD 1 measured before surgery was -2 mm (-2 : The lifted height of eye lid was -2 mm until corneal reflex was seen) to 0.5 mm, showing significant ptosis (average: -0.25±1.10 mm). The MRD 1 measured after placing 10% phenylephrine into the eye varied from 0 mm to 4 mm (average: 2.31±1.22 mm), and the average of lid elevation was 2.56±0.98 mm (Table 2).

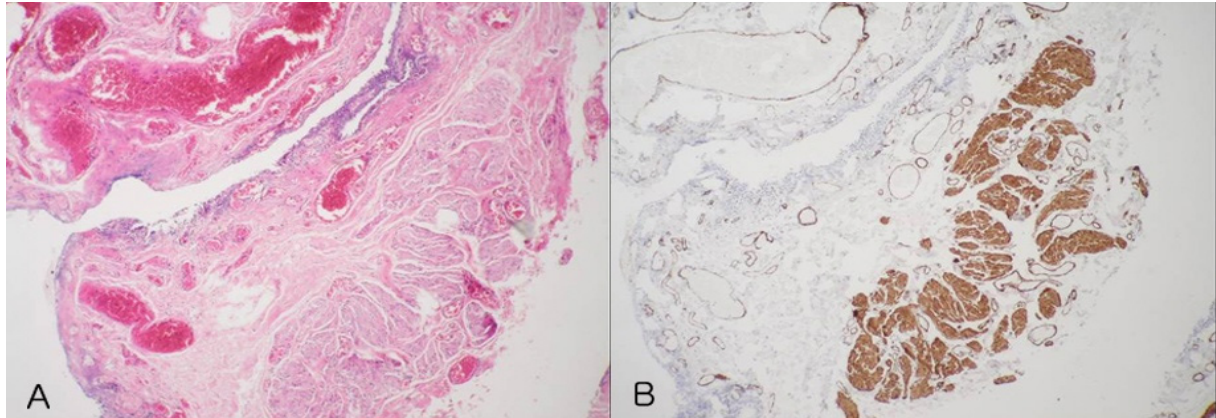
**Table 2.** MRD 1 at phenylephrine test in preoperative state

Case	Preoperative MRD 1 (mm)		Differences of MRD 1 (mm)
	before phenylephrine	after phenylephrine	
1	-2	2	4
2	0	2	2
3	-2	0	2
4	0.5	2	1.5
5	0.5	3	2.5
6	0.5	4	3.5
7	0	3.5	3.5
8	0.5	2	1.5
Mean	-0.25±1.10	2.31±1.22	2.56±0.98

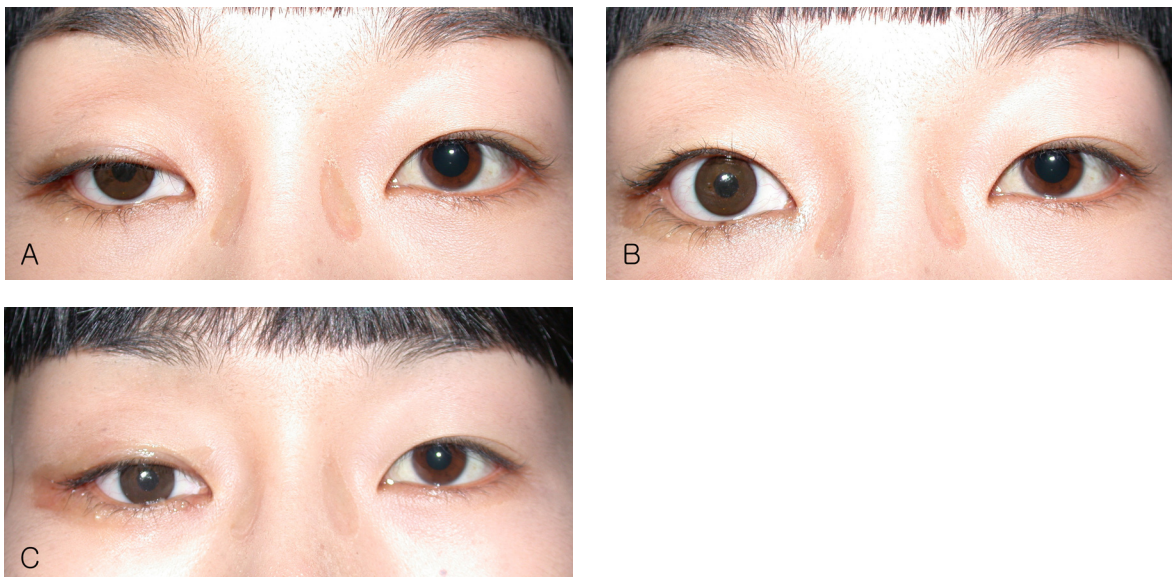
**Table 1.** Patient demography

Case	Sex/Age	Operation type	Implant insertion	Additional op. before müllerectomy	Onset of ptosis (months)
1	F/44	enucleation	20mm Medpor®	augmentation	14
2	M/31	enucleation	21mm HA*	-	34
3	M/27	enucleation	20mm Medpor®	-	5
4	F/40	evisceration	20mm Medpor®	-	unknown
5	F/19	enucleation	20mm Medpor®	augmentation	17
6	M/21	evisceration	20mm Medpor®	-	unknown
7	M/55	enucleation	21mm HA*	augmentation	14
8	F/50	evisceration	20mm Medpor®	-	1

\* : hydroxyapatite.



**Fig. 1.** Pathologic biopsy of surgical resection after conjunctivomüllerectomy using H & E staining (A) and immunohistochemistry staining of smooth muscle actin (B). ( $\times 200$ )



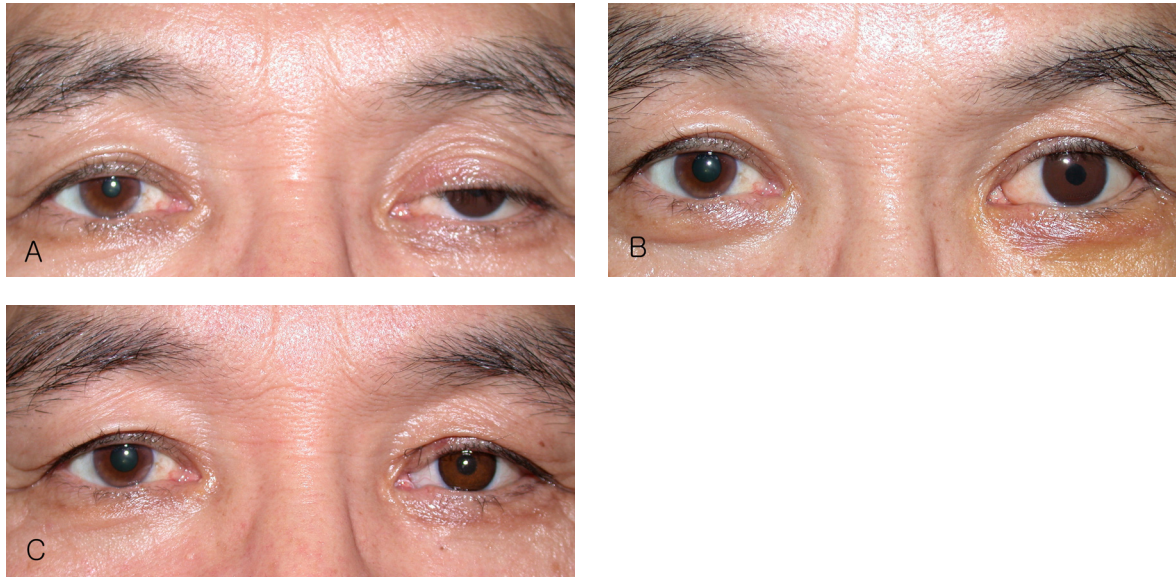
**Fig. 2.** Patient 1. (A) patient with right anophthalmic ptosis. (B) elevation of right eyelid after instillation of 10% phenylephrine hydrochloride. (C) postoperative state of conjunctivomüllerectomy.

After confirming that all patients responded to 10% phenylephrine, conjunctiva-Müller muscle resection was performed to improve lid elevation. Histopathologic examination was performed on tissue specimen obtained during surgery. H & E staining and immunohistochemical staining of smooth muscle actin were used to confirm the presence of Müller muscle, and it was observed in all samples (Fig. 1). The average follow-up period after surgery was 8.1 months. The MRD 1 showed significant improvement in all patients by postoperative 1 month (Fig. 2, 3). The average lid elevation over 1 month after surgery was  $1.81 \pm 0.88$  mm, showing less lid elevation compared with that seen before surgery in phenylephrine test. However, the difference in MRD 1 was less than 1mm compared with the normal eye in all patients except in one patient, suggesting successful surgical outcome (Table 3). Postoperative

complication such as difficulty of inserting the false eye due to conjunctival sac shrinkage or dry eye was not seen.

## Discussion

Massry et al.<sup>5</sup> coined the term, "post-enucleation socket syndrome" for ocular complications in anophthalmic patients that would include ptosis, lower lid laxity, deep superior sulcus, and enophthalmos, which require surgical correction in most cases. Among these complications, ptosis is caused by trauma or edema (transient ptosis), dehiscence of the levator aponeurosis, injury to the superior rectus and levator muscle, ocular palsy, congenital or acquired ptosis, and orbital volume loss in most cases.<sup>2</sup> Conjunctiva-Müller muscle resection was first introduced by Putterman and Urist in 1975. This procedure is effective in improving instability

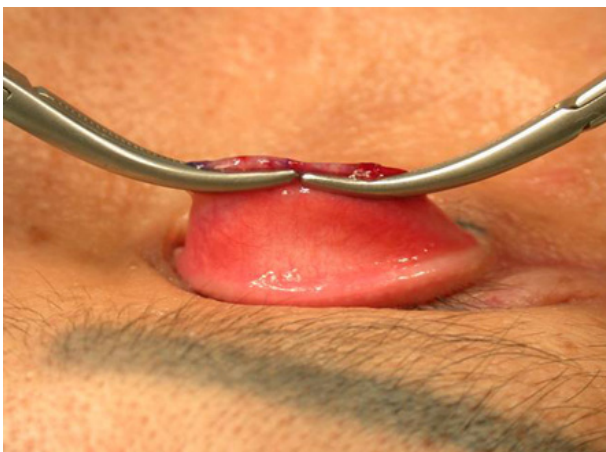


**Fig. 3.** Patient 2. (A) patient with left anophthalmic ptosis. (B) elevation of left eyelid after instillation of 10% phenylephrine hydrochloride. (C) postoperative state of conjunctivomüllerectomy.

**Table 3.** Changes of MRD 1 after conjunctivomüllerectomy

Case	MRD 1 (mm)				MRD 1 differences in both eyes (mm)	Δ MRD 1* (mm)	Follow up time (months)
	preoperative		postoperative (over 1 month)				
	Sound eye	Ptotic eye	Sound eye	Ptotic eye			
1	3	-2	2.5	1.5	1	3.5	16
2	2.5	0	2.5	2	0.5	2	15
3	2.5	-2	2	-0.5	2.5	1.5	14
4	2	0.5	2	1	1	0.5	9
5	2	0.5	2	2	0	1.5	5
6	3	0.5	3	3	0	2.5	2
7	1.5	0	1	1.5	0.5	1.5	2
8	2	0.5	2	2	0	1.5	2
Mean						1.81±0.88	8.1

\* : postoperative MRD 1 - preoperative MRD 1 in anophthalmic eye.



**Fig. 4.** Clamping with two curved mosquito holders just above superior tarsal border.

and corneal irritation by reducing the drawbacks resulted from the Fasanella-Servat procedure by resecting the conjunctiva, Müller muscle and tarsal plate at the same time. Furthermore, it takes short period and less edema to result in fast recovery. Thus, this procedure was reported to be effective in those patients who showed the indications for the Fasanella-Servat procedure.<sup>1,6</sup>

We performed conjunctiva-Müller muscle resection according to the procedure suggested by Putterman. However, 2 curved mosquito holders were used instead of a one-toothed blade used to ligate the conjunctiva-Müller muscle. By facing the holder tip upward, ligation of the conjunctiva-Müller muscle was done close to the holder (Fig. 4). Instead of using a marking suture, a marking pen was used to mark the ligation site. When additional resection was needed, additional conjunctiva-Müller muscle was ligated to

make the height of both eyes matched. Studied by many authors, the amount of conjunctiva-Müller muscle resection differed according to authors. A linear relationship was shown between the amount of resection and lid elevation,<sup>7</sup> emphasizing the importance of resection amount in predicting the height of lid elevation after conjunctiva-Müller muscle resection.

Putterman et al. initially performed conjunctiva-Müller muscle resection in 25 patients using 8 mm resection and reported that the difference according to phenylephrine test was less than 0.5 mm. They recommended 9 mm resection in those patients with mild lid elevation after phenylephrine use and 7 mm resection in those with excess lid elevation.<sup>1</sup> Based on 8.25 mm resection amount, Brown et al.<sup>8</sup> recommended 6.25-8 mm resection in those patients with mild lid elevation after phenylephrine use and 8.5-9.75 mm resection in those with severe lid elevation, and reported that additional blepharoplasty is not effective after conjunctiva-Müller muscle resection since no significant difference was seen in those ptotic patients who underwent conjunctiva-Müller muscle resection and blepharoplasty at the same time. However, Buchman et al.<sup>9</sup> reported that the amount of Müller muscle was little or was not present at all in 88% from the resected tissue samples obtained from 40 patients who underwent the Fasanella-Servat procedure and that no significant difference was seen in the amount of Müller muscle resection even with severe lid elevation patients. Thus, they explained the mechanism of lid elevation involved in conjunctiva-Müller muscle resection with posterior lamellar shrinkage, secondary contractile cicatrization of the wound and advancement of the Müller muscle-levator aponeurosis complex. Perry et al.<sup>6</sup> proposed the algorithm of conjunctiva-Müller muscle resection and reported successful outcomes by performing additional upper tarsal plate resection in those cases undercorrected through 9 mm conjunctiva-Müller muscle resection.

Surgical outcomes were successful in this study by resecting the varied amounts of conjunctiva-Müller muscle from 7.5 mm to 9 mm, based on 8 mm. For example, the case 7 patient who underwent conjunctiva-Müller muscle resection 6 months after augmentation due to deep superior sulcus showed the MRD 1 of 3.5 mm according to phenylephrine test. The MRD 1 measured on postoperative one month was 1.5 mm and the MRD 1 of sound eye was 1.5 mm before surgery. Furthermore, MRD 1 difference between both eyes was less than 0.5 mm, showing clinically satisfactory outcome and the patient was also satisfied. Karesh et al.<sup>2</sup> reported that the average lid elevation after surgery was 3.33 mm and less than 1 mm MRD 1 difference between both eyes in 31 (88.6%) out of 35 patients. According to the results of the present study, the average lid elevation was 1.81 mm, showing 1.5 mm improvement of MRD 1. This difference was probably due to secondary cicatrization rather than due to the difference in the amount of conjunctiva-Müller muscle resection. Conjunctival scarring

was not seen in all 8 eyes in this study; thus, we believe that the effect of lid elevation was little but the frequency of complications due to conjunctival scarring such as ocular irritation was reduced. The lid elevation differed by 2.5 mm between two eyes after surgery in one patient (case 3). We did not expect successful outcome in this patient since the difference of MRD 1 between both eyes was 2 mm even after the use of 10% phenylephrine solution. Despite this problem, we went ahead with conjunctiva-Müller muscle resection since the patient was afraid of complications due to using other methods elevating the upper eyelid. Nonetheless, the procedure itself resulted a significant improvement of 1.5 mm in lid elevation.

During surgery to correct ptosis in anophthalmic patients, surgeons need to be careful to prevent conjunctival shrinkage, which would make the insertion of the false eye difficult, and bulging false eye or blinking due to excessive elevation. We believe that conjunctiva-Müller muscle resection is one of the effective methods of correcting ptosis by preparing an opening in the upper portion of the eyelid with no damage to the upper tarsal plate, which could lead to lid instability and buckling. Moreover, none of the patients had any shallowing of the superior fornix, drying of the socket, or compromise of prosthesis retention postoperatively. Nonetheless, a suitable method of correcting ptosis should be chosen after careful evaluation on the cause of ptosis by examining preoperative levator functions and Müller muscle paralysis.

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