

Levator Aponeurosis and Muller Muscle Plication Reinforced With Levator Sheath Advancement for Blepharoptosis Correction

Jin Suk Byun, MD, PhD,* Kun Hwang, MD, PhD,[†] Sang Yun Lee, MD,* Hak Tae Kim, MD,* and Kenneth Kim, MD[‡]

Abstract: The authors innovated the levator aponeurosis and Muller muscle plication reinforced with levator sheath advancement (AMPSA) for blepharoptosis correction. The orbital septum was opened 1 mm above its fusion with the levator aponeurosis. The preaponeurotic fat was retracted and the thickened part of the levator sheath was identified. Two plication sutures were made: medial suture at the medial border of the pupil and lateral between the lateral border of the pupil and the lateral limbus. A needle with 6-0 nylon thread first bit the tarsal plate approximately 1 mm below its upper border, then bit the levator aponeurosis and the Muller muscle together at 3 to 6 mm above the upper border of the tarsal plate. The needle bit 1 to 3 mm of the thickened part of the levator sheath and the suture was tied. A total of 116 eyes were operated on using levator aponeurosis and Muller muscle plication (AMP), and 79 eyes using AMPSA. The mean follow-up period was 11.4 months. In the AMP group, the postoperative marginal reflex distance-1 (MRD-1) (3.8 ± 0.2 mm) was significantly greater than the preoperative MRD-1 (2.7 ± 0.3 mm) ($P < 0.001$). In the AMPSA group, the postoperative MRD-1 (3.5 ± 0.3 mm) was also significantly greater than the preoperative MRD-1 (1.7 ± 0.4 mm) ($P < 0.001$). The improvement in MRD-1 was greater in the AMPSA group (1.7 ± 0.4 mm) than in the AMP group (1.1 ± 0.3 mm) ($P < 0.001$). The difference in the MRD-1 outcome between AMPSA and AMP (0.6 mm) was obtained by advancing the thickened part of the levator sheath. AMPSA may be an effective procedure for correcting blepharoptosis.

Key Words: Blepharoptosis, eyelids, oculomotor muscles

(*J Craniofac Surg* 2017;28: 1849–1851)

Several methods exist for blepharoptosis correction: aponeurotic surgery, Muller muscle resection, levator resection, frontalis

From the *S leaders Aesthetic Surgical Clinic, Daegu; [†]Department of Plastic Surgery, Inha University School of Medicine, Incheon, Korea; and [‡]University of California, Los Angeles, CA.

Received January 31, 2017.

Accepted for publication March 16, 2017.

Address correspondence and reprint requests to Kun Hwang, MD, PhD, Department of Plastic Surgery, Inha University School of Medicine, 27 Inhang-ro, Jung-gu, Incheon 22332, South Korea; E-mail: jokerhg@inha.ac.kr

This work is supported by a grant from the National Research Foundation of Korea (NRF-2017R1A2B4005787).

The authors report no conflicts of interest.
Copyright © 2017 by Mutaz B. Habal, MD
ISSN: 1049-2275

DOI: 10.1097/SCS.0000000000003815

suspension, and the modifications thereof. The indications for each method vary, and each method has advantages and disadvantages.

In our previous review, the mean improvement in the marginal reflex distance-1 (MRD-1) after Muller muscle resection, levator resection, and frontalis suspension was found to decrease over the course of follow-up to varying degrees.¹

We innovated the levator aponeurosis and Muller muscle plication reinforced with levator sheath advancement (AMPSA) method for blepharoptosis correction and applied it to blepharoptosis patients.

PATIENTS AND METHODS

Operative Methods

Levator Aponeurosis and Muller Muscle Plication

An incision line was designed along the upper tarsal crease. Redundant skin was excised. The orbicularis oculi muscle was incised and the orbital septum was opened. The preaponeurotic fat was retracted cephalad. Two plication sutures were made: a medial suture and a lateral suture. The medial plication suture was made at the medial border of the pupil. The lateral plication suture point was between the lateral border of the pupil and the lateral limbus.

A needle with 6-0 nylon thread first bit the tarsal plate approximately 1 mm below its upper border, then bit the levator aponeurosis and Muller muscle together 3 to 6 mm above the upper border of the tarsal plate according to the degree of blepharoptosis. The plication sutures were tied. A double fold was made with a single-knot plication suture.² The level of the continuous suture passing through the tarsal plate was determined according to the designed height of the double fold line. The skin was closed with single interrupted sutures (Fig. 1).

Levator Aponeurosis and Muller Muscle Plication Reinforced With Levator Sheath Advancement

An incision line was designed along the upper tarsal crease. Redundant skin was excised. The orbicularis oculi muscle was incised and the orbital septum was opened 1 mm above its fusion with the levator aponeurosis. Preaponeurotic fat was retracted cephalad and the thickened part of the levator sheath was identified, usually in the upper third of the space between the upper border of the tarsal plate and the superior transverse ligament (Fig. 2).³ Two plication sutures were made: a medial suture and a lateral suture. The medial plication suture was made at the medial border of the pupil. The lateral plication suture point was between the lateral border of pupil and the lateral limbus. A needle with 6-0 nylon thread first bit the tarsal plate approximately 1 mm below its upper border, then bit the levator aponeurosis and Muller muscle together at 3 to 6 mm above the upper border of the tarsal plate, according to the degree of blepharoptosis. The needle bit 1 to 3 mm of the thickened part of the levator sheath and the suture was tied (Fig. 3). A double fold was made with a single-knot plication suture. The level of the continuous suture passing through the tarsal plate was

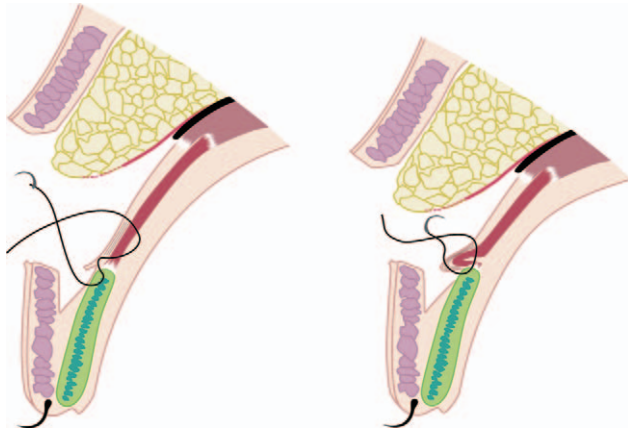


FIGURE 1. Levator aponeurosis and Muller muscle plication. Left: a needle with 6-0 nylon thread first bit the tarsal plate approximately 1 mm below its upper border, then bit the levator aponeurosis and Muller muscle together at 3 to 6 mm above the upper border of the tarsal plate according to the degree of blepharoptosis. Right: the plication suture was tied.

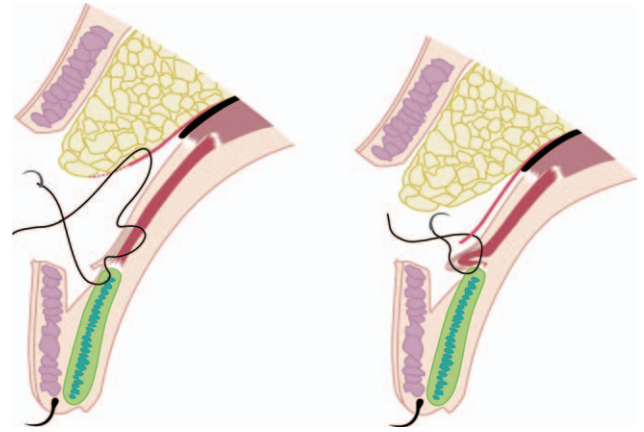


FIGURE 3. Levator aponeurosis and Muller muscle plication reinforced with levator sheath advancement. Left: a needle with 6-0 nylon thread first bit the tarsal plate approximately 1 mm below its upper border, then bit the levator aponeurosis and Muller muscle together at 3 to 6 mm above the upper border of tarsal plate, according to the degree of blepharoptosis. The needle bit 1 to 3 mm of the thickened part of the levator sheath and the suture was tied.

determined according to the designed height of the double fold line. The skin was closed with single interrupted sutures.

Patients

From December 2014 to May 2016, 116 eyes were operated on with levator AMP, and 79 eyes were operated on with levator AMPSA. The mean follow-up period was 11.4 months.

Usually, AMP was performed in patients with an MRD-1 of 2 to 4 mm, while AMPSA was performed in patients with an MRD-1 of less than 2 mm.

RESULTS

The mean preoperative MRD-1 was 2.3 ± 0.6 mm, and the mean postoperative MRD-1 was 3.7 ± 0.3 mm. The mean improvement in the MRD-1 was 1.3 ± 0.5 mm.

Marginal Reflex Distance-1 of AMP and AMPSA
Marginal Reflex Distance-1 Associated With AMP (Mild) and AMPSA (Moderate)



FIGURE 2. The thickened part of the levator sheath (TLS, held by 2 forceps). The orbital septum was opened 1 mm above its fusion with the levator aponeurosis. The preaponeurotic fat was retracted cephalad. The TLS was identified, usually in the upper third of the space between the upper border of the tarsal plate and the superior transverse ligament.

In the AMP group, the postoperative MRD-1 (3.8 ± 0.2 mm) was significantly greater than the preoperative MRD-1 (2.7 ± 0.3 mm) ($P < 0.001$ [independent 2-sample *t* test]).

In the AMPSA group, the postoperative MRD-1 (3.5 ± 0.3 mm) was also significantly greater than the preoperative MRD-1 (1.7 ± 0.4 mm) ($P < 0.001$ [independent 2-sample *t* test]) (Table 1).

The improvement in MRD-1 (Δ MRD-1) was greater in the AMPSA group (1.7 ± 0.4 mm, $111.4\% \pm 86.6\%$ increment) than in the AMP group (1.1 ± 0.3 mm, $42.0\% \pm 16.7\%$ increment) ($P < 0.001$ [independent 2-sample *t* test]) (Table 2).

Relationship of Age and Improvement in Marginal Reflex Distance-1

No significant relationship was found between age and Δ MRD-1 ($P = 0.845$, linear regression analysis, correlation analysis).

TABLE 1. Preoperative and Postoperative Marginal Reflex Distance-1

	N	Preoperative MRD-1		Postoperative MRD-1	P Value
AMP	116	2.7 ± 0.3	<	3.8 ± 0.2	<0.001
AMPSA	79	1.8 ± 0.4	<	3.5 ± 0.3	<0.001
Total	195	2.3 ± 0.6	<	3.7 ± 0.3	<0.001

AMP, aponeurosis and Muller muscle plication; AMPSA, aponeurosis and Muller muscle plication reinforced with levator sheath advancement; MRD-1, marginal reflex distance-1.

TABLE 2. Improvement in Marginal Reflex Distance-1

	MRD-1 (mm)			P Value	
	Total	AMP (116)	AMPSA (79)		
Δ MRD-1 (mm)	1.3 ± 0.5	1.1 ± 0.3	<	1.7 ± 0.4	<0.001
Δ MRD-1 (%)	70.2 ± 65.8	42.0 ± 16.7	<	111.4 ± 86.6	<0.001

AMP, aponeurosis and Muller muscle plication; AMPSA, levator aponeurosis and Muller muscle plication reinforced with levator sheath advancement; MRD-1, marginal reflex distance-1.



FIGURE 4. Patient 1. A 22-year-old female who underwent levator aponeurosis and Muller muscle plication on the left side. (Left) Preoperative view. (Right) Postoperative 12 months view.

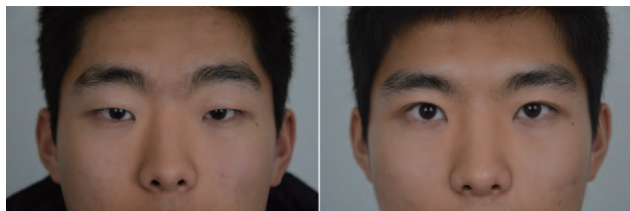


FIGURE 5. Patient 2. A 23-year-old male who underwent levator aponeurosis and Muller muscle plication and reinforcement with levator sheath advancement on the right side. (Left) Preoperative view. (Right) Postoperative 5 months view.



FIGURE 6. Patient 3. A 19-year-old female who underwent bilateral levator aponeurosis and Muller muscle plication and reinforcement with levator sheath advancement, bilateral epicanthoplasty, and left endoscopic forehead lift. (Left) Preoperative view. (Right) Postoperative 4 months view.

Patients

Patient 1. A 22-year-old female who underwent AMP on the left side. The preoperative MRD-1 was 3 mm and the postoperative 12 months MRD-1 was 4 mm (Fig. 4).

Patient 2. A 23-year-old male who underwent AMPSA on the right side. The preoperative MRD-1 was 2 mm and the postoperative 5 months MRD-1 was 4 mm (Fig. 5).

Patient 3. A 19-year-old female who underwent bilateral AMPSA, bilateral epicanthoplasty, and left endoscopic forehead lift. The preoperative 4 months MRD-1 was 1 mm and the postoperative MRD-1 was 4 mm (Fig. 6).

DISCUSSION

In our previous research, the medial pretarsal fat compartment was found to be located in the medial two-fifths of the tarsal plate. The lateral border of the medial pretarsal fat compartment was 0.94 ± 0.22 mm lateral to the medial pupillary border.⁴ Thereafter, we used 2 plication sutures instead of the usual 3 sutures. A medial plication suture was made at the medial border of the pupil, and a lateral plication suture was made at the midpoint of the lateral border of the pupil and the lateral limbus.

In our previous papers, we confirmed that the levator sheath covers the levator aponeurosis, and it continues anteriorly with the inner layer of the orbital septum, as Whitnall described.^{3,5,6}

The Δ MRD-1 was greater in the AMPSA group (1.7 ± 0.4 mm, $111.4\% \pm 86.6\%$ increment) than in the AMP group (1.1 ± 0.3 mm, $42.0\% \pm 16.7\%$ increment) ($P < 0.001$ [independent 2-sample *t* test]). The difference between the AMPSA and AMP results ($1.7 - 1.1$ mm = 0.6 mm) was obtained by plicating the levator sheath. Thus, we can say that the thickened part of the levator sheath is an eyelid-elevating structure.

In conclusion, AMPSA may be an effective procedure for correcting blepharoptosis where the MRD-1 is less than 2 mm.

ACKNOWLEDGMENT

The authors are grateful to Seong Kyung Yoo, BS, Department of Plastic Surgery, Inha University School of Medicine, for statistical analysis.

REFERENCES

1. Hwang K, Ko YS. Improvement of the marginal reflex distance-1 in blepharoptosis surgeries. *J Craniofac Surg* 2016;27:455–460
2. Cho BC, Byun JS. New technique combined with suture and incision method for creating a more physiologically natural double-eyelid. *Plast Reconstr Surg* 2010;125:324–331
3. Whitnall SE. A ligament acting as a check to the action of the levator palpebrae superioris muscle. *J Anat Physiol* 1911;45:131–139
4. Byun JS, Hwang K, Huan F, et al. Medial pretarsal fat compartment as related to upper eyelid surgery. *J Craniofac Surg* 2012;23:1156–1158
5. Hwang K, Huan F, Kim DJ. Levator sheath revisited. *J Craniofac Surg* 2012;23:1476–1478
6. Hwang K, Kim DJ, Chung RS, et al. An anatomical study of the junction of the orbital septum and the levator aponeurosis in Orientals. *Br J Plast Surg* 1998;51:594–598