

Staged Treatment of Asymmetrical Age-related Changes in the Eyelid and Thyroid Eye Disease

Tokuei Takahira, MD
Shinsuke Akita, MD, PhD
Haruka Maei, MD
Yoshitaka Kubota, MD, PhD
Nobuyuki Mitsukawa MD, PhD

Summary: Blepharoplasty for thyroid eye disease (TED) has been indicated for the purpose of improving upper and lower eyelid retraction caused by exophthalmos. Both aponeurotic blepharoptosis and aging lower eyelid are common conditions that require plastic surgeries and could be complicated with other disease conditions, such as TED. This is the first report of planned and staged treatment of the contradictory pathophysiologies of aging changes of upper and lower eyelids associated with TED. A 59-year-old woman suffered complicated bilateral asymmetric aponeurosis blepharoptosis of the lower and upper eyelids, caused by both advanced aging and TED. To achieve aesthetic improvement, three-stage surgical treatments were planned, as follows: (1) Orbital decompression for exophthalmos; (2) Extraocular muscle surgery, if necessary; (3) Blepharoplasty for functional and aesthetic abnormalities due to loosening of the upper and lower eyelids. After medial and lateral orbital floors were opened bilaterally, the patient did not need extraocular surgery. As the final step, levator aponeurosis advancement procedure was performed in the upper eyelids for bilateral asymmetrical aponeurotic blepharoptosis, and transitional lower blepharoplasty using a skin-muscle flap technique via a sub-ciliary incision was performed in the lower eyelids for age-related loosening. The typical face displayed by Graves' disease disappeared, and the symptoms associated with loosening of the upper and lower eyelids improved substantially. Improvement of exophthalmos by orbital decompression revealed the severity of the blepharoptosis and the aging change of lower eyelid. Step-by-step planning from decompression surgery to upper and lower blepharoplasty could lead to sufficient improvement in the facial appearance in TED. (*Plast Reconstr Surg Glob Open* 2021;9:e3706; doi: [10.1097/GOX.0000000000003706](https://doi.org/10.1097/GOX.0000000000003706); Published online 21 July 2021.)

Exophthalmos and eyelid retraction are typical signs of thyroid eye disease (TED) caused by an increasing volume of orbital tissue. The approach of surgical treatment for TED should be planned in staged and sequential operations of orbital decompression, extraocular muscle surgery, and blepharoplasty.¹⁻⁴ In general, blepharoplasty for TED is indicated for the purpose of improving upper and lower eyelid retraction caused by exophthalmos. Few reports have described how to improve exophthalmos and morphology of the eyelids aesthetically.³⁻⁵ Both aponeurotic blepharoptosis and aging lower

eyelid are common conditions requiring plastic surgeries and could be complicated with other disease conditions such as TED. Meanwhile, there is no established treatment strategy for the combined morbidities.

We report a case with bilateral asymmetric aponeurosis blepharoptosis complicated with TED, in which the patient underwent a staged strategic surgery to achieve aesthetic improvement. This is the first report of planned and staged treatment of the contradictory pathophysiologies of aging changes of upper and lower eyelids associated with TED.

CASE PRESENTATION

A 59-year-old woman suffered exophthalmos and blepharoptosis (Figure 1A). She was experiencing Graves' disease and had started medical treatment six years before the consultation. She had undergone topical steroid injection for exophthalmos in another hospital, which, unfortunately, did not improve her exophthalmos. The aging change and ptosis of the eyelid had gradually become her concern.

Disclosure: The authors have no financial interest to declare in relation to the content of this article.

From the Department of Plastic, Reconstructive, and Aesthetic Surgery, Graduate School of Medicine, Chiba University, Chiba, Japan.

Received for publication March 1, 2021; accepted May 27, 2021.

Copyright © 2021 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the [Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 \(CCBY-NC-ND\)](https://creativecommons.org/licenses/by-nc-nd/4.0/), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: [10.1097/GOX.0000000000003706](https://doi.org/10.1097/GOX.0000000000003706)

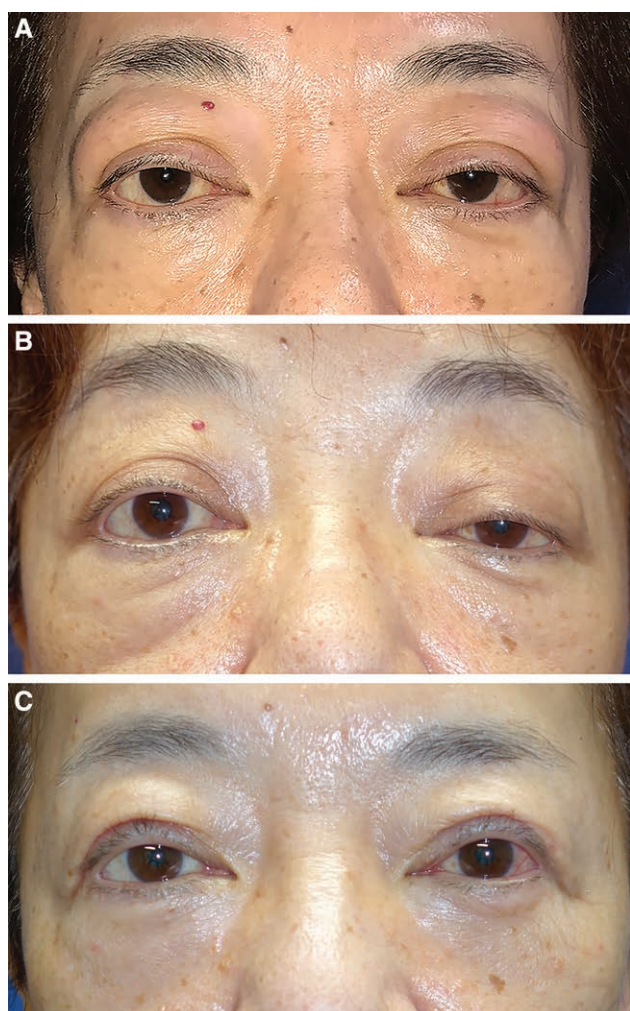


Fig. 1. A 59-year-old woman with exophthalmos and bilateral asymmetric aponeurotic blepharoptosis. A, Preoperative view. At the first visit, the facial blepharoptosis was masked by exophthalmos, making it difficult to determine the degree of ptosis. B, 3 months after the orbital decompression surgery, displaying remarkable improvement. At this stage, the severity of blepharoptosis and age-related changes in the lower eyelids became apparent. C, 6 months after upper and lower eyelid surgeries, showing no disease symptoms and without complications.

The patient's preoperative assessment revealed the following: the degree of exophthalmos was 22mm in the right eye, 23mm in the left eye, margin reflex distance

(MRD)-1 was 2.2mm in the right eye, 1.7mm in the left eye, palpebral fissure height was 9.9mm in the right eye, and 9.2mm in the left eye (Table 1). Exophthalmos was confirmed, with lower eyelid retraction and blepharoptosis in both sides of the eyes. The value of thyroid hormone and TSH were within normal ranges (FT3; 2.44 pg/ml, FT4; 0.99ng/dl, TSH; 1.03 μ IU/ml). Head plain computerized tomography (CT) scan showed exophthalmos, which is the bulging of the eye out of the orbit anteriorly, accompanied by an increase of the orbital tissue on both sides, indicating both eye orbit and extraocular muscles sustained connective tissue deposition. Thus, the patient was diagnosed as having bilateral aponeurosis blepharoptosis, complicated with TED in the stable stage.

We planned three phases of the surgical strategy for this patient's case. First of all, orbital decompression for exophthalmos was scheduled. Secondly, if strabismus, diplopia, or eye movement disorders occurred after the first operation, extraocular muscle surgery would be scheduled. As the final phase, blepharoplasty for functional and aesthetic abnormalities due to loosening of the upper and lower eyelids would be scheduled.

Orbital decompression surgery was performed via a coronal incision. Medial and lateral orbital floors were opened bilaterally. A small amount of orbital fat was removed to adjust for lateral differences in exophthalmos.

Six months after the orbital decompression, the degree of exophthalmos had reduced to 15mm in the right eye and 14mm in the left eye. Because diplopia, strabismus, or eye movement disorders were not observed after the first operation, extraocular muscle surgery was not indicated as the second step. The MRD-1 in the right eye was 2.5mm, left was 0.6mm, and palpebral fissure height in the right eye was 10.2mm, left was 5.5mm (Table 1). The patient was diagnosed with left aponeurotic ptosis and right compensatory over eye-opening, which was explained by the Hering law. In addition, as a result of improved exophthalmos, aging changes in the lower eyelids due to loosening of the septum were observed (Fig. 1B). Accordingly, as the final phase of eyelid surgery, levator aponeurosis advancement procedure was performed in the upper eyelids for bilateral asymmetrical aponeurotic blepharoptosis, and transitional lower blepharoplasty using a skin-muscle flap technique via a sub-ciliary incision was performed in the lower eyelids for age-related loosening.⁶

The follow-up assessment at six months postoperative was as follows: MRD-1 in the right was 2.0mm, left was 2.2mm, the palpebral fissure height in the right eye

Table 1. Perioperative Changes in the Severity of the Disease

	Preoperative	6 Months after First Operation	6 Months after Second Operation
Exophthalmos (mm)			
Right	22	15	15
Left	23	14	14
MRD-1 (mm)			
Right	2.2	2.5	2.2
Left	1.7	0.6	2.0
Palpebral fissure height (mm)			
Right	9.9	10.2	10.3
Left	9.2	5.5	10.5

was 10.3 mm, left was 10.5 mm (Table 1). The facial features of the Graves' disease disappeared, and the symptoms caused by loosening of the upper and lower eyelids had also disappeared. (See figure 1, Supplemental Digital Content 1, which shows computerized tomography images and photographs before and after surgeries. <http://links.lww.com/PRSGO/B715>.)

DISCUSSION

Thyroid ophthalmopathy involves a variety of functional and cosmetic conditions; hence, treatment decisions are complex and must consider a variety of factors.^{1,7,8} We performed staged surgeries for a case with TED, accompanied with bilateral asymmetrical aponeurotic blepharoptosis and age-related changes in the lower eyelids. In this case, two contradicting pathological conditions in the anatomy of the eyelid (upper and lower eyelid retraction due to TED, and loosening of eyelid tissue associated with degenerative change) were present at the same time. These two opposing conditions masked the symptoms of each other, and thus, were challenging to assess the disease severity. (See figure 2, Supplemental Digital Content 2, which shows a schematic of morphological changes of the upper and lower eyelids in TED and aponeurotic ptosis. (a) Age-related loosening of the upper and lower eyelid. (b) Exophthalmos and retraction of the upper and lower eyelids caused by TED. (c) When the conditions are combined, their symptoms are masked, and accurate assessment is difficult. <http://links.lww.com/PRSGO/B716>.) We first treated exophthalmos, and then, eyelid retraction by orbital decompression revealed the severity of the blepharoptosis. The blepharoplasty performed as the final surgery enabled the success of the aesthetically appealing appearance of the eyelids.

One of the reasons for the recommendation of three-step surgeries for TED is that the results of orbital decompression influenced the tension on the extraocular muscle, levator palpebrae muscle, and muller muscle. It has been reported that eye-opening is controlled by the cranial nucleus, which is stimulated through the mechanical receptor of the muller muscle.⁹ Based on this system, we speculated that the change of muller muscle position associated with orbital decompression would also affect the stimulation of eye-opening. Additionally, eye drooping of the unilateral side influences the degree of contralateral eyelid opening, as explained by the Hering law.¹⁰ Therefore, it is reasonable to perform surgery first for physical exophthalmos and to adjust the muscle tone, followed by blepharoplasty with a functional physiologic adjustment.

This report has only one case; therefore, the accumulation and discussion outcomes of other cases, based on the same concept, would be necessary in the future.

CONCLUSIONS

In a patient with TED, it was possible to set a treatment goal to improve the appearance of the eyelids aesthetically by a staged surgical plan. Improvement of exophthalmos by orbital decompression revealed the severity of the blepharoptosis and the aging changes in the lower eyelids. Step-by-step planning from decompression surgery to upper and lower blepharoplasty could lead to a favorable result in the facial appearance of TED.

Shinsuke Akita, MD, PhD

Department of Plastic, Reconstructive, and Aesthetic Surgery
Chiba University Graduate School of Medicine
1-8-1 Inohana, Chuo-ku, Chiba City
Chiba 260-8670
Japan
E-mail: shinsukeakitapr@gmail.com

ACKNOWLEDGMENT

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional committee and with the ethical principles stated in the Helsinki declaration.

PATIENT CONSENT

The patient provided written consent for the use of her image.

REFERENCES

1. Tallstedt L. Surgical treatment of thyroid eye disease. *Thyroid*. 1998;8:447–452.
2. Bartalena L, Baldeschi L, Dickinson A, et al; European Group on Graves' Orbitopathy (EUGOGO). Consensus statement of the European Group on Graves' orbitopathy (EUGOGO) on management of GO. *Eur J Endocrinol*. 2008;158:273–285.
3. Shorr N, Seiff SR. The four stages of surgical rehabilitation of the patient with dysthyroid ophthalmopathy. *Ophthalmology*. 1986;93:476–483.
4. Taban MR. Combined orbital decompression and lower eyelid retraction surgery. *J Curr Ophthalmol*. 2018;30:169–173.
5. Ribeiro SF, Shekhovtsova M, Duarte AF, et al. Graves lower eyelid retraction. *Ophthalmic Plast Reconstr Surg*. 2016;32:161–169.
6. Maffi TR, Chang S, Friedland JA. Traditional lower blepharoplasty: is additional support necessary? A 30-year review. *Plast Reconstr Surg*. 2011;128:265–273.
7. Leone CR. The management of ophthalmic Graves' disease. *Ophthalmology*. 1984; 91:770–779.
8. Morax S, Hurbli T. Choice of surgical treatment for Graves' disease. *J Craniomaxillofac Surg*. 1987;15:174–181.
9. Matsuo K, Ban R, Ban M. Desensitization of the mechanoreceptors in Mueller muscle reduced the increased reflex contraction of the orbicularis oculi slow-twitch muscle fibers in blepharospasm. *Eplasty*. 2014; 14: e33.
10. Parsa FD, Wolff DR, Parsa NN, et al. Upper eyelid ptosis repair after cataract extraction and the importance of Hering's test. *Plast Reconstr Surg*. 2001;108:1527–36; discussion 1537.