

# The outcome of upperlid lowering by using auricular cartilage as a spacer for thyroid-related upper eyelid retraction

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**Objective:** To review the outcome of upper lid lowering by using auricular cartilage as the spacer for thyroid-related upper eyelid retraction.

**Methods:** A case series comprised of 23 eyes which were diagnosed with medium/severe graded thyroid-related upper eyelid retraction. The patients were operated at Ho Chi Minh City Eye Hospital, using auricular cartilage as the spacer to lower upper lid. Data were collected before and during 6 months after the surgery.

**Results:** More than 90% of preoperative symptoms improved: good upper lid lowering (95.65%), lagophthalmos improved (100%). Only 13.04% of eyes remained lateral upper eyelid retraction. Complications: keratopathy (8.68%); graft extrusion (0%); ptosis (0%). Only 1 eye was recurrent (4.34%).

**Conclusion:** Upper lid lowering by using auricular cartilage as the spacer is a safe and effective method to treat thyroid-related upper eyelid retraction. This method brings good cosmetic results and improves keratopathy because of upper lid retraction.

**Conflicts of interest:** The authors report no conflicts of interest.

**Keywords:** upper lid lowering, auricular cartilage

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## Introduction

Upper eyelid retraction is defined as being present when the upper eyelid is above the normal position in primary gaze. At the normally straight position of the eye, 2 mm is covered by the upper lid from the superior limbus of the cornea. Upper lid retraction can have many causes, the most common of which is thyroid eye disease. In dysthyroid upper eyelid retraction, causative factors of the disease include sympathetic stimulation of Muller's muscle and increased tone and over-activity

of levator-superior rectus muscle complex secondary to fibrosis of the inferior rectus.<sup>1,2</sup> Upper eyelid retraction surgical correction not only improves the cosmetic aspect of the patients, removing their ferocious look due to lid lowering, but protects the cornea as well. The surgery is scheduled when the disease condition is stable, the patient's thyroid function is normal, and the upper eyelid condition has been stable for at least 6 months. There are many approaches to treating upper eyelid retraction. Anterior approaches consist of levator muscle recession with or without adjustable sutures; Mullerectomy or Mullerotomy; levator muscle marginal myotomy; stepped complete palpebral incision; and Z-plasty. Muller and levator

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muscle posterior (conjunctival) approaches were also reported and adjusted.<sup>1,3-5</sup> These approaches vary in initial and postoperative effectiveness despite the stable underlying thyroid disease. There is a hypothesis indicating that these approaches make a cavity in the upper eyelid which enhances the wound healing process which in turn stimulates the retraction. Hence, with a spacer placed as a wedge between the levator aponeurosis and the upper lid tarsal plate, the retraction could be restrained.<sup>7</sup> In this study, we evaluated the effectiveness of the surgery in thyroid-associated upper eyelid retraction using auricular cartilage as a spacer. This is an easily taken autologous material, which rarely causes complications and cosmetic deformation at the cartilage position and on itself. The cartilage is flexible but strong enough to maintain the form and the postoperative lid lowering effectiveness.

### Methods

We did a prospective study on 17 patients from 24 to 72 years old, consisting of 8 males and 9 females; in total, there are 23 eyes investigated, 9 right eyes and 14 left ones. Among those, 6 patients were operated on both eyes, and the other 11 patients were operated on one eye.

The selection criteria included patients with moderate or severe thyroid-associated upper eyelid retraction being stable for at least 6 months, and with settled thyroid function.

Upper eyelid retraction classification is based on MRD (Margin Reflex Distance):

- Mild retraction:  $MRD \leq 5$  mm
- Moderate retraction:  $5 \text{ mm} < MRD \leq 7$  mm
- Severe retraction:  $MRD > 7$  mm<sup>6</sup>

All patients were examined before and after surgery by the same ophthalmologist and were operated on by the same surgeon. Medical history regarding retraction was carefully explored and documented with cornea-related symptoms caused by wid-

ened palpebral aperture like dry eye, irritated feelings, burning and scratchy eyes, a feeling of something in the eye, excess watering, blurred vision, or photophobia. Preoperative assessment was carried out to evaluate the degree of upper eyelid retraction, the measure of palpebral aperture, the corneal condition and other thyroid-associated eye manifestations, if present. Patients were examined to evaluate thyroid function including fT3, fT4, TSH, TRAb (TSH receptor antibody); thyroid ultrasound; and the enlargement of recti muscles and optic nerve by orbital ultrasound and CT scans. An eyelid lengthening surgery was done after the surgery on orbital decompression and strabismus in case of operative indication.

### SURGERY PROCEDURE

1. Posterior auricular cartilage harvesting (Figure 1)



**Figure 1:** Posterior auricular cartilage harvesting

- Subcutaneously anaesthetize posterior auricular area
- Skin incised and dissected to expose the sub-perichondrium plane
- Use blade No.11 and compatible scissors to harvest the cartilage with the size: 25 mm in length \* (MRD – 2.5 mm) in height
- Close the postauricular incision with a 7.0 silk suture.

2. Cartilage transplantation technique

- Evert the upper eyelid
- Inject anesthetic solution to the fornix of conjunctiva (Figure 2)

-Dissect conjunctiva from superior eyelid tarsal border and Muller's muscle to the upper margin (Figure 3)



**Figure 2:** Injection of anesthetic solution to the fornix of conjunctiva



**Figure 3:** Dissection of conjunctiva from superior eyelid tarsal border and Muller's muscle to the upper margin

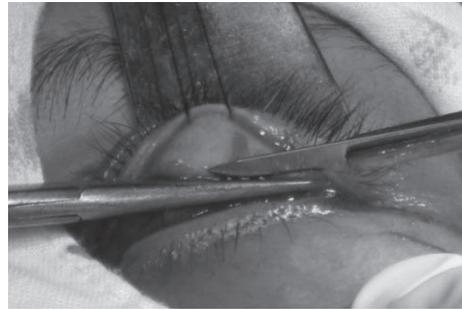
-Use fine toothed forceps to grasp the complex of levator muscle and Muller's muscle, and remove it from superior tarsal border (Figure 4)

-Suture the auricular cartilage between the tarsus and levator muscle – Muller's muscle by 6.0 Vicryl suture (Figure 5)

-Suture the conjunctiva back to superior eyelid tarsal border to line the interior surface of the transplanted cartilage.

Postoperatively, patients were evaluated after 1 week, 1 month, 3 months and 6 months. Important points of follow-up examination include: upper lid lowering degree; palpebral aperture degree; the healing of corneal disease or other preoperative accompanied symptoms; and com-

plications. Cosmetic factors such as two eye symmetries, height of the upper lid crease, and the cartilage area were carefully observed upon re-examination. Lid contour was evaluated mainly on whether the normal curvature of the lid was preserved. Regarding the spacer, follow-up examination focused on the question of if the spacer was rejected or contracted.



**Figure 4:** Removal of the complex of levator muscle and Muller's muscle from superior tarsal border



**Figure 5:** Suture of the auricular cartilage between the tarsus and levator muscle – Muller's muscle

#### **Evaluation standard**

1. Evaluate the orbital protective functional recovery: postoperative eyelid lowering degree, at every follow-up examination (1 month, 3 months and 6 months) and the recurring rate by MRD index (marginal reflex distance).

-Acceptable:  $3.5 \text{ mm} \leq \text{MRD} \leq 5 \text{ mm}$

-Overcorrected:  $2.5 \text{ mm} \leq \text{MRD} < 3.5 \text{ mm}$

-Undercorrected:  $\text{MRD} > 5 \text{ mm}$

-Recurrence is defined by having MRD 1-month post-op > 5 mm.

2. Evaluate cosmetic recovery with two eyelid apertures symmetry through dMRD index (the difference index in lid apertures between left and right side)

-Good:  $0 \text{ mm} \leq \text{dMRD} < 1 \text{ mm}$

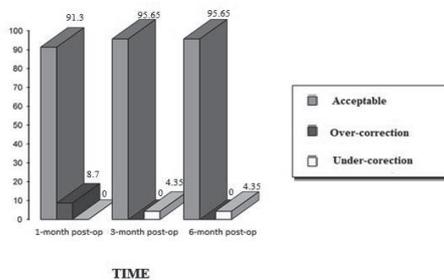
-Satisfied:  $1 \text{ mm} \leq \text{dMRD} < 2 \text{ mm}$

-Unacceptable:  $\text{dMRD} \geq 2 \text{ mm}$

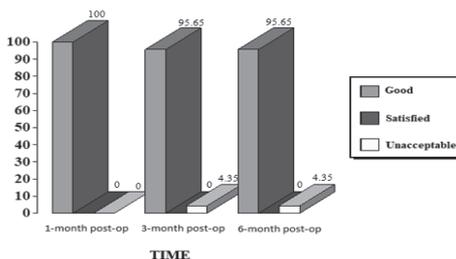
3. Evaluate corneal symptoms preoperatively and postoperatively: basing on clinical signs and BUT diagnostic test (tear film break-up time)

### Results

17 patients comprised of 8 men and 9 women with 23 eyes with thyroid-associated eyelid retraction at moderate ( $5 \text{ mm} < \text{MRD} \leq 7 \text{ mm}$ ) and severe ( $\text{MRD} > 7 \text{ mm}$ ) degree were operated by auricular cartilage transplantation to lowering the upper lid at Ho Chi Minh City Eye Hospital. Results about orbital protective function are summarized in Figure 6. Results about cosmetic recovery are presented in Figure 7



**Figure 6:** Results about orbital protective function



**Figure 7:** Results about cosmetic recovery



**Figure 8:** Upper eye: Thyroid-associated upper lid retraction (Upper image: pre-op; Lower image: 6 months post-op lid lengthening – Good result)



**Figure 9:** Both eyes: Improved corneal condition after lid lengthening surgery (Upper image: Right eye: 1-week post, Left eye: pre-op; Lower image: 6 months post-op lid lengthening)

In 3 eyes with remaining temporal eyelid retraction, 2 were corrected by additional levator dissecting operation in temporal canthus area, so this condition was well improved. High lid crease complications were relatively common, up to 43.48%; however, these complications increasingly improved over time, with continued follow-up.

BUT and other symptoms of postoperative palpebral aperture corneal illness were completely improved.

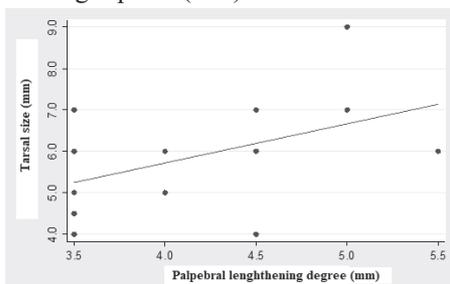
**Table 1:** Remaining limitations after 6 months post-operatively

Post-op Limitations	N	%
0.5 mm mild eyelid aperture	4	17.39
High lid crease, thick lid	10	43.48
Lid curvature abnormality	3	13.04
Mild temporal eyelid retraction	3	13.04

**Table 2:** Postoperative complications

Complications	N	%
Superior marginal keratitis +/- ulceration	2	8.69
Blepharitis	8	34.78
Granulomatous conjunctivitis	1	4.35

Other complications (included eyelash loss; dry eye; graft rejection; wound slowly or barely healing) were undocumented in follow-up period (6 months since operation). Auricular cartilage harvesting area healed well, not affecting patients' comfort regarding the function and cosmetic aspects. When exploring the correlation between the cartilage spacer size and the palpebral lengthening degree, the Spearman correlation coefficient is 0.8112 ( $p=0.0000$ ). Correlation equation: Palpebral lengthening degree (mm) =  $-0.148 + 0.750 * \text{size of cartilage spacer (mm)}$



**Figure 10:** Scatter plot for the palpebral lengthening degree

### Discussion

Whether being a separate manifestation or accompanying with bulging eye, lower

eyelid retraction, thyroid-associated upper eyelid retraction still significantly affects the eyelid's cosmetic aspect and its corneal protective function. There are many corrective surgeries for this upper eyelid condition depending on severity, accompanying illness, and the period of thyroid-associated orbital disease. The classic methods like levator muscle recession with or without adjustable suture; Mullerectomy or Mullerotomy; marginal myotomy; stepped complete palpebral incision; and Z-plasty have been practiced for a relatively long time because of their effectiveness in upper eyelid retraction at a mild and moderate degree. At the severe degree, the effectiveness of these methods has not been supported. Many opinions indicate that these methods made a cavity in upper eyelid, which enhanced the wound healing process and stimulated retraction. Consequently, with a spacer placed between the levator aponeurosis and the upper lid tarsal plate as a wedge, the retraction could be limited.<sup>7</sup> This is the premise of the research of eyelid lengthening methods using spacers. The many materials that can be used are sclera; nasal cartilage; the other eye's tarsal plate; hard palate mucous membrane, and

more.<sup>6,7</sup> However, there have been many issues such as rejection; spacer retraction; complications at the cartilage harvesting area; and the complicated and time-consuming techniques of harvesting those materials. The ideal spacer must bring out a predictable result, be stable and have few complications. Auricular cartilage is an autologous material that doesn't need complicated technique or much time to harvest. Moreover, auricular cartilage is both elastic and hard enough to be a wedge for creating a stable shape for the eyelid. For all the above reasons, we proceeded to study the primary effectiveness of the operation using auricular cartilage as a wedge on thyroid-associated upper lid retraction cases from moderate to severe.

In this research, we realized that a palpebral lengthening effect was achieved on over 95.65% of patients; the recurrent rate was very low, only 4.34% (1 in 23 eyes). In addition, the rate of good cosmetic requirements in eye symmetry was very high, 95.65%; unsatisfied rate was 0%; and unacceptable rate was only 4.34% (the above case has recurrent retraction). In these surgeries, because the sizes of cartilage spacers were calculated precisely pre-op, patients did not need to sit up many times to evaluate the lid lengthening degree as other previous methods. This is another convenience of this operative method.

Besides, in the collected reference documents, we have not found any information mentioning about the change in eyelid lengthening degree as the size of the auricular cartilage spacer varied. Hence, we studied the correlation between the size of the cartilage spacer and the palpebral lengthening degree 6 months postoperatively and got the Spearman correlation coefficient of 0.8112 with *p*-value of 0.0000. The connection between these two variables are also addressed in the following regression equation:

Palpebral lengthening degree (mm) =

$-0.148 + 0.750 \times \text{cartilage spacer size (mm)}$   
In this equation, we made regression between these two variables: the palpebral lengthening degree, which is calculated by the difference between the preoperative MRD (marginal reflex distance) and 6-month postoperative MRD; and the size of auricular cartilage spacer.

Prob > F of 0.0000 showed that the model can be expressed for population with significance level of 5%.

And, the Squared correlation coefficient (R-squared) = 0.7163 = 71.63% told that the size of cartilage spacers could explain for 71.63% of the changes in the lengthening degree after 6 months.

Regarding complications, the most serious observed was superior marginal keratitis and ulceration (4.34%), and another case had a less serious complication: superior marginal superficial punctate keratitis. In our opinion, the cause of these complications was the fact that these were our first cases in the study, and we did not preserve the conjunctiva to cover the cartilage spacer; in the later cases with conjunctiva covering the spacer, there were totally no affected areas on the cornea. Moreover, there was still one granulomatous inflammation that responded well to the steroid eye drops. Blepharitis complications were seen in 34.78% of cases.

## Conclusion

Use of external auricular cartilage as a wedge between levator aponeurosis and the upper lid tarsal plate seems to be the ideal method to correct thyroid-associated upper eyelid retraction of a moderate to severe degree because of high effectiveness, low recurrent rate, and few mild complications. However, the study is preliminary, and the sample number is not large enough to result in statistically significant conclusions.

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