The Efficacy of Orbital Septal Flap in the Treatment of Moderate and Severe Upper Eyelid Retraction

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**ORIGINAL INVESTIGATION**

**Purpose:** To assess the long-term effectiveness of the orbital septal flap to lengthen the levator muscle in management of moderate and severe upper eyelid retraction.

**Methods:** This study reported 46 eyes of 43 consecutive patients with moderate or severe upper eyelid retraction who were recommended for surgery. The period of the study was between October 2016 and October 2019. All cases were evaluated for eyelid position before and at 3, 6, and 12 months after the operation. Successful outcome was defined as "perfect," "acceptable," and "failure".

**Results:** The average age was 33.3 years (range, 16–59 years). The average orbital septal flap height was 5.28 ± 0.77 mm. Before surgery, 78.3% had 1 of 3 central upper eyelid retraction (group 1), and 21.7% had 1 of 3 lateral upper eyelid retraction (group 2). During follow-up postoperatively, all eyelid parameters of upper marginal reflex distance, upper scleral show, and palpebral fissure height significantly decreased compared with preoperative values in both groups. The result was considered "perfect" or "acceptable" in 42 eyes (91.3%). However, at 12 months after surgery, of the 36 middle eyelid retraction cases (group 1), 35 (97.2%) showed a successful outcome (perfect or acceptable results), while the success rate in group 2 was 70% (7 of 10 cases), a significant difference ($p = 0.008$). No severe complications were seen during follow up.

**Conclusions:** Orbital septal flap is a safe and reliable procedure for management of upper eyelid retraction of moderate and severe degree.

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Upper eyelid retraction management remains one of the most challenging aspects of ophthalmic plastic surgery. In addition to innovations in nonsurgical treatment, numerous surgical procedures for correction of upper eyelid retraction involve recession, lengthening, or excision of either or both the levator and Muller muscle via a cutaneous or conjunctival approach. In 2003, Elner et al. reported their results using the graded full-thickness anterior blepharotomy technique initially described by Koornneef in 1999. Then, Hintschich and Haritoglou suggested to start the full-thickness incision temporally to produce eyelid symmetry and 95% of operated eyelids achieved a "perfect" or "acceptable" result in their study. Kazim and Gold (2011) reviewed Elner’s procedure as one of the most popular techniques to treat upper eyelid retraction which gained wide acceptance in the oculoplastic community. These techniques have been continually developing to improve the cosmetic and functional results following surgery.

In 2002, Lai et al. described a new technique of levator muscle lengthening for the retracted upper eyelid by designing a new flap, the orbital septal flap, to interpose between the recessed levator muscle complex and the tarsus. In 2013, Watanabe et al. reported preliminary outcomes of this technique in a series of 12 eyelids of 10 patients with thyroid eye disease (TED) and assessed the feasibility of creating a flap in a variety of cases with upper eyelid retraction. In the present article, the authors performed this technique in 43 patients to assess the long-term efficacy for treatment of moderate and severe upper eyelid retraction.

**METHODS**

This prospective, interventional case series included 46 eyes of 43 consecutive patients with moderate or severe upper eyelid retraction at Vietnam National Institute of Ophthalmology, Hanoi, Vietnam, between October 2016 and October 2019. Surgeries were performed by a single surgeon (NTTH in Hanoi). The study protocol and ethical issues were approved by the institutional ethics committee and adhered to the Declaration of Helsinki.

Inclusion criteria for this study included age less than 60 years, moderate or severe upper eyelid retraction according to Elner classification that required surgical correction and had no previous upper eyelid surgery. Informed consent and images were obtained from all patients. The following data were entered into a database: name, age, sex, systemic status, follow-up period, clinical symptoms, and signs. To assess the differences, palpebral fissure height, upper marginal reflex distance (MRD1), upper scleral show, distance of the skin crease from the center of the eyelid margin, upper eyelid margin contour (C), and exophthalmos (by Hertel exophthalmometer) were recorded preoperatively and during the follow-up visits. To identify the upper eyelid margin contour (C), the first vertical line was drawn through the pupil center and the second one was drawn to the highest point of the upper eyelid. The distance between these 2 lines was defined as the upper eyelid margin contour (C). This index normally is close to 0. When there are changes in the eyelid position, values can be changed.
The patients were divided into 2 groups according to the location of upper eyelid retraction: patients with retraction more pronounced in the central one-third portion of the upper eyelid (group A) and the remaining patients (group B) with upper eyelid retraction more pronounced in the lateral one-third portion.

The postoperative eyelid position was graded according to Mourits and Sasim\textsuperscript{10} and classified as “perfect” result; “acceptable” result; or “failure.” Statistical analyses were performed using SPSS software version 26.0 (IBM, Armonk, NY). A $p$-value less than 0.05 was considered statistically significant. Student $t$-test was used to evaluate the changes in eyelid parameters after surgery. Correlation between flap height and MRD1 was evaluated using the Pearson correlation test.

**Surgical Technique.** After marking the upper eyelid skin crease and injecting the local anesthetic, an incision about 30 mm long was made along the upper eyelid crease through the skin and the orbicularis muscle was divided to expose the tarsal plate (Fig. 1A). The levator Muller’s complex was detached from the tarsus at a level immediately above the upper tarsal border without opening the orbital septum. Levator aponeurosis was resected, exposing Muller’s muscle at the confluence of the upper tarsal border and septum. Then, Muller’s muscle was dissected from the underlying conjunctiva, and mullerectomy was performed. The remaining eyelid retraction was adjusted by calculating the orbital septal size. The width of the orbital septal flap was identified based on tarsal plate length, which was about 20 mm. However, the orbital septal height was adjusted depending on upper eyelid retraction to gain adequate contour. In addition, with the central upper eyelid retraction, the authors designed a rectangular flap while lateral upper eyelid retraction was used trapezoid flap (Fig. 2). The orbital septum was detached from the arcus marginalis, around 15 mm above the white line of levator aponeurosis (Fig. 1B). Its medial and lateral borders were incised (Fig. 1C); and the flap was reflected inferiorly. The septal flap was sutured to the anterior superior two-thirds or superior border of the tarsal plate (2 or 3 sutures) using 6/0 Vicryl sutures (Fig. 1D), sutures being corrected for acceptable contour and height of the upper eyelid (see Video, Supplemental Digital Content 2, available at http://links.lww.com/IOP/A315).

**RESULTS**

In this study, 46 eyes of 43 consecutive patients with moderate or severe upper eyelid retraction underwent levator muscle lengthening using orbital septal flap. Minimum follow up was 12 months (range, 12–37 months) with a mean follow up of 22.06 months. There were 25 women (58.2%) and 18 men (41.8%). The mean age was 33.3 ± 32.5 (range, 16–59 years). The etiology of upper eyelid retraction was congenital (7 of 43 patients) (16.3%); secondary after TED (32 of 43) (74.4%); and miscellaneous entities (4 of 43) (9.3%).

Of 43 patients, 78.3% had the central one-third of the upper eyelid retraction (group 1), while the remaining 21.7% had the lateral one-third of the upper eyelid retraction (group 2). Good results were shown in all patients at 1 week and 1 month after surgery. Three months after surgery, no recurrent case (0%) appeared in group 1, while 4.3% of patients were not ed in group 2. This difference was statistically significant ($p = 0.007$). At 12 months after surgery, of the 36 central eyelid retraction cases, 35 (97.2%) showed a successful outcome (perfect and acceptable results), while the success rate in group 2 was 70% (7 of 10 cases), a significant difference ($p = 0.008$). There was a remarkable reduction in mean MRD1, palpebral fissure height, eyelid lag, upper eyelid margin contour (C), skin crease, and upper scleral show during follow up. Figure 3 is a line graph of pre- and postoperative MRD1. MRD1 (mm) was taken preoperatively, 1 month, 3 months, 6 months, and 12 months postoperatively were 5.97 ± 0.85, 2.98 ± 0.50, 3.32 ± 0.26, 3.34 ± 0.36, and 3.43 ± 0.26, respectively. MRD1 differed significantly from pre- and postoperatively ($p = 0.001$). The results of eyelid changes at 12 months postoperative are summarized in Table.

Preoperative lagophthalmos was present in 5 of 46 (10.8%) eyelids. Lagophthalmos resolved in all patients after 12 months postoperatively. The difference between preoperative and postoperative lagophthalmos was statistically significant ($p = 0.001$). Corneal exposure keratopathy was present in 13 of 46 (28.3%) eyes preoperative. The postoperative reduction to 4.3% in corneal exposure keratopathy at 12 months after surgery was statistically significant ($p = 0.001$). The mean length of orbital septal flaps for lengthening the levator muscle was 5.28 ± 0.77 mm (5.62 ± 0.46 mm for severe retraction and 4.95 ± 1.01 mm for moderate retraction). The difference between groups was not statistically significant ($p = 0.425$). Postoperative eyelid position was

**FIG. 1.** Surgical technique. **A,** Skin incision is made and the orbicularis muscle is divided to expose the tarsal plate and levator aponeurosis. **B,** The orbital septum is identified and detached from the arcus marginalis, around 15 mm above the white line of LA. **C,** The orbital septum medial and lateral borders are incised, and the flap is reflected inferiorly. **D,** The septal flap is sutured to the tarsal plate using 6-0 Vicryl sutures. **E,** The distal edge of the septal flap is included in the orbicularis closure. **F,** Skin incision.
"perfect" in 36 eyes (78.2%), "acceptable" in 6 cases (13.04%), and "failure" in 4 eyes (8.7%). The final result at 1 year following surgery was satisfactory in 84.78% (Figs. 4 and 5). There were no significant eyelid or ocular surface complications in any patients (see Figure, Supplemental Digital Content 1, available at http://links.lww.com/IOP/A314).

**DISCUSSION**

Upper eyelid retraction can be caused by a diversity of mechanisms. It can result from tissue loss or scarring that contracts the anterior lamella, secondary to superficial injuries such as burns, and due to overactivity of Muller’s muscle with/without the levator muscle due to Grave’s disease.11 Using the turn-over orbital septal flap combined with levator recession technique, in a previous study of Watanabe et al., 10 of 10 (100%) upper eyelid retraction patients were secondary to TED and no previous upper eyelid surgery, the postoperative eyelid position was found to be perfect in 70% patients, acceptable in 20% patients. In our study, 7 of 43 cases (16.3%) were congenital upper eyelid retraction 7 of 43; 32 of 43 (74.4%) were secondary after TED and 4 of 43 (9.3%) were miscellaneous entities. Although the authors included congenital and unidentified upper eyelid retraction in this study, our result was in accordance with the result in previous study. One year following surgery, successful results were achieved in 91.3% (42 of 46) patients and the authors found no differences between the successful outcomes between TED, congenital or miscellaneous entities groups. Therefore, the results of surgery seem not to have been correlated with etiologic factors in our study.

The goal of eyelid retraction management is to prevent exposure keratopathy, relieve ocular discomfort, and restore patient appearance.8 From an aesthetic aspect, successful results have been reported for eyelid parameters. In addition to nonsurgical treatments, multiple techniques have been reported to achieve favorable outcomes. These include recession/resection of Muller’s muscle alone; recession/resection of the levator muscle and aponeurosis recession/resection with or without Muller’s muscle12–14; levator lengthening by marginal myotomy/Z myotomy11,15,16; or reattachment of the recessed levator to the tarsus with various flaps or spacers,17–19 adjustable sutures,20 or using an anterior or posterior approach. However, none of these has been proven superior. In 2002, Lai et al.8 first described a successful case with a new technique for levator lengthening to treat upper eyelid retraction. They used the orbital septal flap as a vascularized spacer to reattach the recessed levator complex and the tarsus to correct the upper eyelid retraction. The orbital septum is a sheet of fibrous tissue that arises from the periorbital space and separates into 2 distinct layers in the distal area. The anterior layer extends to the eyelid margin and covers the tarsus entirely. The posterior layer reflects and attaches to the anterior layer of the levator aponeurosis.21 Fusion between the orbital septum and the

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**FIG. 2.** Orbital septal flap design. **A,** Rectangular flap. **B,** Trapezoidal flap

**FIG. 3.** Changes in upper marginal reflex distance (MRD1) preoperatively and 1, 3, 6, and 12 months postoperatively (mm).

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**Summary of 12-month postoperative change in eyelid parameters**

|                  | Pre-op Mean (SD) | 12 months post-op Mean (SD) | Asymmetry Mean (SD) | P     |
|------------------|------------------|----------------------------|---------------------|-------|
| MRD1 (mm)        | 5.97 (0.85)      | 3.43 (0.26)                | 0.03 (0.02)         | 0.001 |
| PFH (mm)         | 12.65 (1.41)     | 10.10 (0.29)               | 0.09 (0.08)         | 0.001 |
| Upper scleral show (mm) | 1.70 (0.73)   | 0.01 (0.07)                | 0.01 (0.07)         | 0.001 |
| C (mm)           | 1.09 (2.14)      | 0.35 (0.21)                | 0.35 (0.21)         | 0.007 |
| LF (mm)          | 14.24 (2.12)     | 14.41 (2.05)               | 0.20 (0.78)         | 0.146 |
| Eyelid lag (mm)  | 2.26 (1.07)      | −0.73 (0.66)               | 0.48 (0.50)         | 0.001 |
| Skin crease (mm) | 5.38 (0.89)      | 6.13 (1.12)                | 0.01 (0.22)         | 0.002 |

Asymmetry: the differences in eyelid parameters between OD and OS 12 months postoperatively.

C, upper eyelid margin contour; LF, levator muscle function; MRD1, upper marginal reflex distance; PFH, palpebral fissure height; Post-op, postoperation; Pre-op, preoperation.
levator aponeurosis in Asians is thought to be lower than that in Caucasians. However, recently, Kakizaki et al. demonstrated otherwise. The average distance of the fusion point from the superior tarsal border was 4.44 mm in Asians (0.7–8.6 mm) and 3.71 mm in Caucasians (0.7–7.6 mm), with no difference in attachment site between the orbital septum and the levator aponeurosis.22,23 This is a suggested landmark to expose the orbital septum during surgery. In addition, the orbital septum is extremely thin in older patients, who might not be good candidates for this technique. Therefore, the eldest patient in our study was 59 years to ensure a thick enough orbital septum flap to lengthen the levator muscle. Eyelid crease is easily addressed when the upper eyelid recession procedures are conducted. In 2004, Elner et al. reported the use of graded anterior blepharotomy to treat upper eyelid retraction in 32 patients with Graves eye disease. Although the advantage of this technique includes preservation of levator aponeurosis fibers forming the eyelid crease, eyelid crease recession or asymmetry still occurred in 4 of 22 patients. They also indicated that lateral temporal flare is easily addressed when the lateral horn is cut through an anterior approach. Kuzmanović Elabjer et al. suggested that lateral eyelid lowering is the most difficult part of retraction surgery and if the eyelid is still high

FIG. 4. A 22-year-old female patient with right upper eyelid retraction. A, Preoperative appearance of asymmetrical upper eyelid retraction. B, Marked improvement of eyelid retraction after surgery.

FIG. 5. A 35-year-old female patient with right upper eyelid retraction. A, Preoperative appearance of asymmetrical upper eyelid retraction. B, Marked improvement of eyelid retraction after surgery.
after the lateral levator horn has been removed, the lateral end of Whitnall’s ligament should be cut. In our study, to correct the lateral contour flare, a rectangular orbital septum flap was designed for central upper eyelid retraction and a trapezoid flap was adjusted for lateral upper eyelid retraction. In addition, postoperative eyelid crease increasing was tried to avoid by decreasing 1 to 2 mm of the marking point for upper eyelid crease incisions and the septal flap was sutured to the anterior superior two-thirds or superior border of the tarsal plate. No patient reported any abnormality in eyelid crease height after surgery.

In 2013, a similar technique to that in our study was reported by Watanabe et al. They described their surgical technique to treat 12 eyelids of 10 patients with TED underwent a transcutaneous levator lengthening technique using the reflected orbital septum. In this case series, a flap was used with or without a graded recession of the levator aponeurosis. However, Watanabe et al. did not show the number of cases that they conducted graded recession in the context of anterior blepharotomy. They just indicated that a graded full-thickness blepharotomy is applied for more severe cases of retraction. In our procedure, the levator muscle proximal to Whitnall’s ligament was divided and recessed in all patients to decrease the change of recurrent retraction. The reason, probably, is that all our patients had moderate or severe upper eyelid retraction.

When comparing the success rates with those of established procedures, the outcomes of eyelid correction using this flap in this study were similar. Ceisler et al. treated moderate to severe thyroid-related upper eyelid retraction with mullerotomy and recession of the levator aponeurosis combined with medial transposition of the lateral horn of the levator aponeurosis. The efficacy of graded anterior blepharotomy to treat upper eyelid retraction, as reported by Elner et al., was demonstrated through comparison of preoperative and postoperative eyelid parameters in 50 eyelids of 32 patients with Graves disease-associated upper eyelid retraction. They found that, at a mean (SD) of 8.5 (8.1) months (range, 2–35 months) follow up, more than 90% of preoperative symptoms had resolved or improved. Upper eyelid position (p < 0.001), lagophthalmos (p < 0.001), and keratopathy (p < 0.01) were significantly improved.

In previous study of Watanabe et al., at an average of 13 months postoperatively, the palpebral aperture was reduced by 2.5 mm on average (p < 0.001) and was within 1 mm of the desired position in 11 of 12 cases (92%); the position of the skin crease was within 1 mm of the desired position in all cases, which compares well to the results of our study. However, previous studies did not mention the relationship between surgical outcome and location of upper eyelid retraction. In this study, 78.3% of patients were considered to have 1 of 3 central upper eyelid retraction (group 1), and the remaining 21.7% have 1 of 3 lateral upper eyelid retraction (group 2). At 3 months after the surgery, 0% recurrence was observed in group 1, while this rate in group 2 was 4.3%. This difference was statistically significant (p = 0.008). At 12 months after surgery, of the 36 central eyelid retraction cases in groups 1, 35 (97.2%) showed a successful outcome, while only 7 of 10 cases in group 2 were successful (70%), a significant difference (p = 0.008). Therefore, the location of upper eyelid retraction might be a factor to predict the possibility of recurrence for TED patients. This correlation needs to be assessed and discussed in future studies. The current study has some limitations such as the absence of large enough number of patients, and the lack of comparison with other spacers to ascertain whether it carries any advantages or benefit over other nonautogenous materials.

**CONCLUSION**

Using orbital septal flap for management of moderate and severe upper eyelid retraction is safe and effective. In addition, this procedure is a reliable option to correct various degrees of upper eyelid retraction.

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