

A Novel Technique for the Permanent Restoration of Pretarsal Fullness of the Lower Eyelids

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Abstract

Background: The presence of static pretarsal fullness is an essential aesthetic feature in Asian culture that endows a youthful and smiling attractive look to the face. The restoration of static pretarsal fullness using acellular dermal matrix implantation or autogenous fascia grafting can result in suboptimal outcomes because of the unpredictable resorption rate. Therefore, a new method is required to achieve a stable, long-term, and natural result.

Objectives: The authors describe a new method to address the deficiency of static pretarsal fullness.

Methods: Sixteen Asian female patients with a deficiency of static pretarsal fullness who received implantation of a bundle of implants consisting of segmented Gore-Tex sutures (W. L. Gore & Associates, Inc., Flagstaff, AZ) overlaid with a mastoid fascia graft were retrospectively evaluated in a 15-year period from July 2007 to July 2022. Patients were assigned to categories based on the pretarsal fullness contour.

Results: Sixteen female patients aged between 22 and 40 years (mean age: 30.375 ± 7.580) underwent the procedure. The mean follow-up period was 52.25 (± 33.757) months (range, 6-120 months). Fourteen patients were considered to have satisfactory results. However, 2 patients encountered complications, one of which was a case of infection that was successfully managed through revision and led to an excellent outcome. The other patient experienced malposition, which was also corrected successfully through revision.

Conclusions: Our new method for creating pretarsal fullness using Gore-Tex suture implants overlaid with a retroauricular mastoid fascia graft is effective in achieving aesthetic static pretarsal fullness and obtaining excellent permanent cosmetic outcomes.

Level of Evidence: 4

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Pretarsal fullness, commonly referred to as the pretarsal roll, is a defining feature of the eyelids, which can be broadly categorized into static and dynamic types. In particular, the restoration of static pretarsal rolls is of great significance, particularly in Asian culture, where it is associated with a more youthful, warm, and amiable expression, as well as a more aesthetically appealing appearance of the eyes. One study reported that the prevalence of static

and dynamic pretarsal fullness was 19.2% and 74.0%, respectively, underscoring the importance of restoring static

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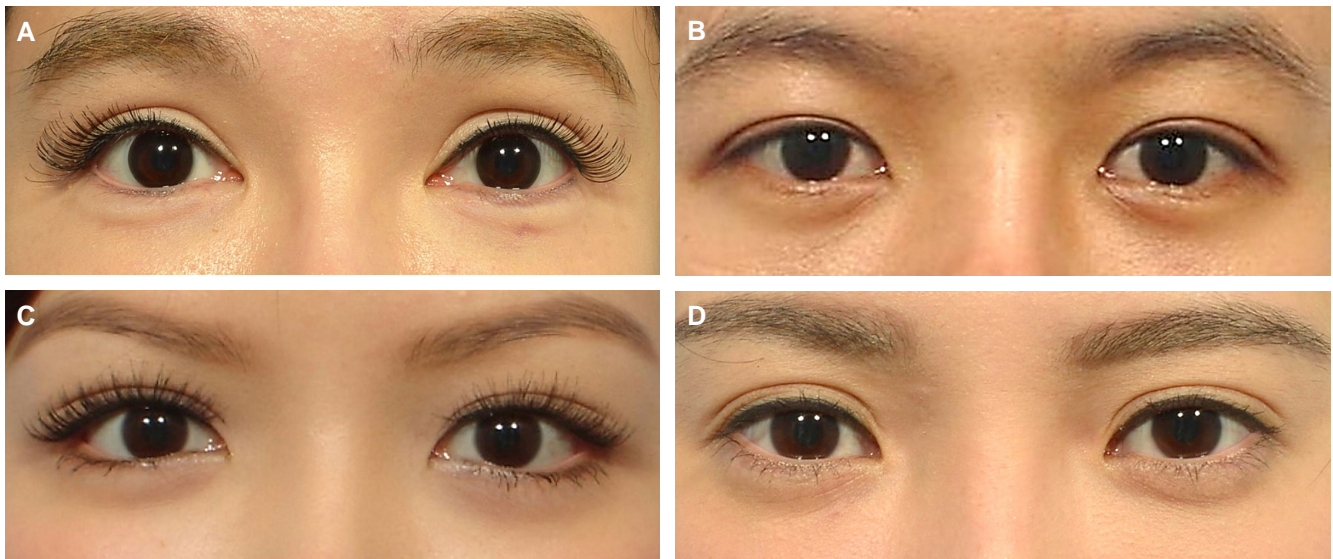


Figure 1. Four types of static pretarsal fullness: (A) a 32-year-old female patient with roll type; (B) a 28-year-old female patient with crescent type; (C) a 33-year-old female patient with spread-out type; and (D) a 30-year-old female patient with mixed type.

pretarsal fullness in achieving optimal aesthetic outcomes.¹ Based on our observation, static pretarsal fullness can be categorized into 4 types: roll type, crescent type, spread-out type, and mixed type (Figure 1). To date, only 2 studies have reported successful permanent creation of static pretarsal fullness using deep temporal fascia grafts² and acellular dermal matrix (ADM; Megaderm; L & C BIO Corp., Seongnam-si, Korea) with respectively.³ However, ideal aesthetic static pretarsal fullness requires sufficient projection and width (Figure 2). Unfortunately, these materials have an unpredictable resorption rate,^{4,6} which can result in suboptimal outcomes such as sagging of the pretarsal fullness (Figure 3). Therefore, a compelling need exists for a novel approach capable of producing stable, long-lasting, and aesthetically pleasing outcomes.

METHODS

This study presents the long-term follow-up results of a novel method for enhancing the static pretarsal region. From July 2007 to October 2022, 16 female patients aged between 22 and 40 years (mean age: 30.375 ± 7.580) underwent the procedure. The mean follow-up period was $52.25 (\pm 33.757)$ months (range, 6-120 months).

This study was approved by the ethics board of our clinic and was conducted in accordance with the principles set forth in the Declaration of Helsinki. Approval from an Institutional Review Board was not required because all products utilized were indicated for cosmetic surgery use. All patients in the study gave informed consent for the surgical procedures and to have their photographs published in the medical literature or for instructional purposes.

Implant Design

The Gore-Tex suture implant was fabricated by dividing 3-0 Gore-Tex sutures (expanded polytetrafluoroethylene or ePTFE; W. L. Gore & Associates, Inc., Flagstaff, AZ) into segments ranging in length from 15 to 25 mm in length depending on individual variation (Figure 4). Based on the patient's preferred size, 15 or 20 segments were chosen and united using 7-0 vicryl to form a Gore-Tex bundle. The terminal portions of the implant were precisely beveled with a surgical knife to conform to the shape of the pretarsal fullness. Typically, we positioned the longer beveled side at the lateral area of the pretarsal zone as a standard practice. Once the implant was well prepared, it was soaked in solution containing 50 cc of 5% povidone-iodine, 1 g cefazolin, 80 mg gentamicin.

Harvest of Mastoid Fascia Grafts

The mastoid fascia grafts were harvested through a longitudinal incision located at the retroauricular groove (Figure 5). The remaining mastoid dead space was closed by progressive tension sutures.⁷

Surgical Procedures

The procedure was performed under mild intravenous sedation and local anesthesia. A conventional subciliary incision was made about 1.5 to 2 mm below the lower eyelash line, and dissection was carried down to the level of the tarsal plate, after which both skin-muscle flaps were raised. The dissection was then extended cephalically to the point where the eyelash roots were faintly visible, and minimally

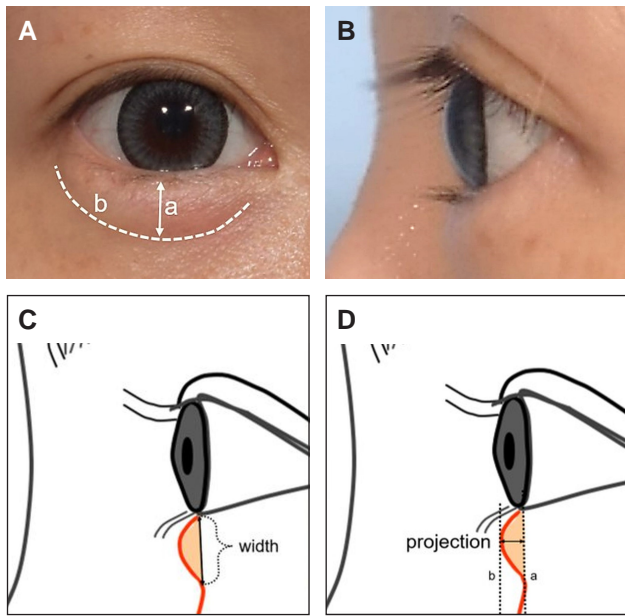


Figure 2. The ideal aesthetic static pretarsal fullness should have adequate projection and width as shown in a 22-year-old female patient shown at (A) anterior view (a: width of pretarsal fullness. b: pretarsal crease) and (B) lateral view. (C) Illustration shows width of pretarsal fullness. (D) Illustration shows projection of pretarsal fullness.



Figure 4. Displaying the Gore-Tex (W. L. Gore & Associates, Inc.) bundle which is produced by sectioning 3-0 Gore-Tex sutures into segments ranging in length from 15 to 25 mm.

caudally extended (2-3 mm) to the preseptal region to create a suitable pocket for the implant and fascia graft. The prefabricated Gore-Tex suture implants were secured to the midportion of the Tarsal Plate 2 of the lower eyelid using three to four 7-0 vicryl sutures (Ethicon, Raritan, NJ; Figure 6A-C). A 20 to 25 mm long, 2.5 mm wide, and 2 mm thick segment of fascia graft that had been previously harvested was then attached to the outer surface of the implant with three 7-0 vicryl sutures. The wound was closed in layers involving muscle and skin using continuous 7-0 vicryl sutures (Figure 6D). An open dressing was applied to the wound, and ophthalmic ointment was used.

Postoperative Assessment

After surgery, patients underwent follow-up appointments at 3 and 6 months, with subsequent appointments every 6

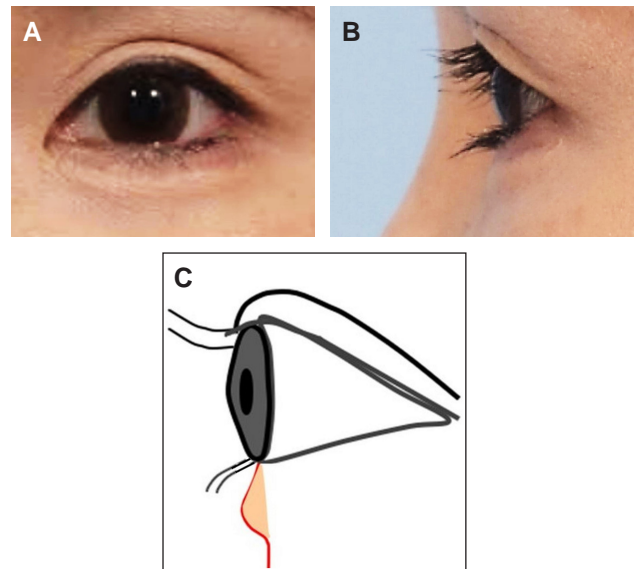


Figure 3. A 31-year-old female patient previously underwent a lower pretarsal augmentation procedure with ADM, specifically Megaderm (L & C BIO Corp.), 2 years ago. She presented with the occurrence of sagging in the pretarsal region where ADM was utilized, resulting in a loss of fullness. She is shown at (A) anterior view and (B) lateral view. (C) Illustration of the lateral view shows sagging pretarsal fullness.



Figure 5. The mastoid fascia grafts which were harvested through a longitudinal incision located at the retroauricular groove.

months. For patients who lived outside of Taiwan, evaluations were conducted via email Q&A and attached images. At each follow-up session, which occurred at 6 months or later, patients were photographed, clinically evaluated, and asked to rate their surgical outcome as good (not troublesome), “fair (slightly troublesome),” or “poor (very troublesome).” Aesthetic outcomes were assessed by the investigators and categorized as “excellent,” “good,” “fair,” or “poor” based on the criteria outlined in Table 1. Outcomes related to malposition, sagging, or a less visible pretarsal crease that caused slight annoyance were rated as fair, whereas those associated with infection or extrusion were scored as poor.

RESULTS

Postoperatively out of the 16 patients, 7 were categorized as having a “roll”-type fullness (Figure 7), 6 had a

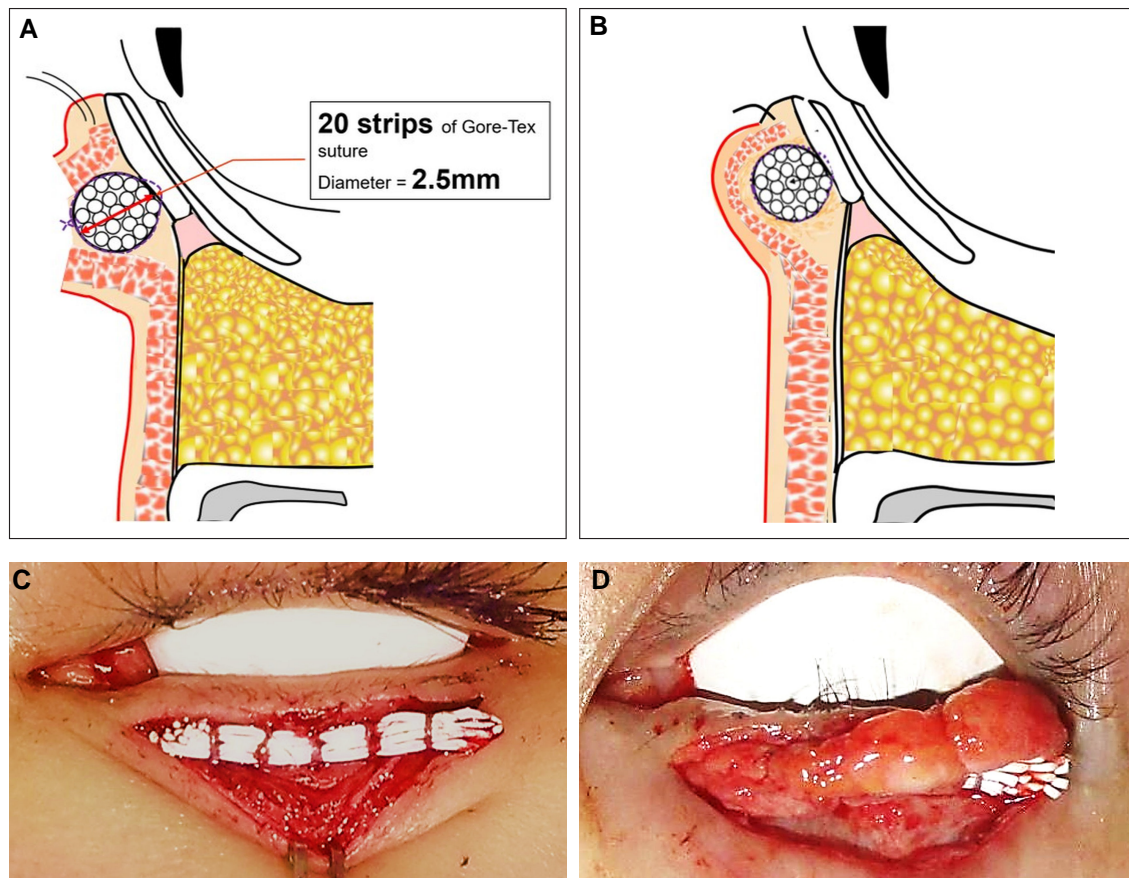


Figure 6. A 26-year-old female patient underwent a lower pretarsal augmentation procedure. Illustrations show (A) the fixed Gore-Tex (W. L. Gore & Associates, Inc.; Flagstaff, AZ) suture implant and (B) the finished restoration of pretarsal fullness. (C) Intraoperative photo shows the Gore-Tex suture implant sutured at the midportion of the tarsal plate of the lower eyelid. (D) Fascia graft is covering the Gore-Tex bundle implant.

“crescent” type (Figure 8), 2 had a “spread-out” type (Figure 9), and 1 had a “mixed” type (Figure 10). Further information about the patients’ characteristics and outcomes can be found in Table 2. There are 14 primary cases and 2 secondary cases (Figures 11, 12). Of the total patients, 7 achieved excellent results, 7 obtained good results, one had a fair result due to malposition, which was corrected successfully 9 months later. One patient had a poor outcome due to an infection (Figure 13). No Gore-Tex suture granuloma was noted.

The dynamic pretarsal fullness observed after the pretarsal augmentation procedure appears to be natural (Figures 8C, D; 11C, D). None of the patients reported any issues with animation during the postoperative period.

DISCUSSION

The pretarsal fullness is associated with the pretarsal portion of the orbicularis oculi muscle (OOM) from an

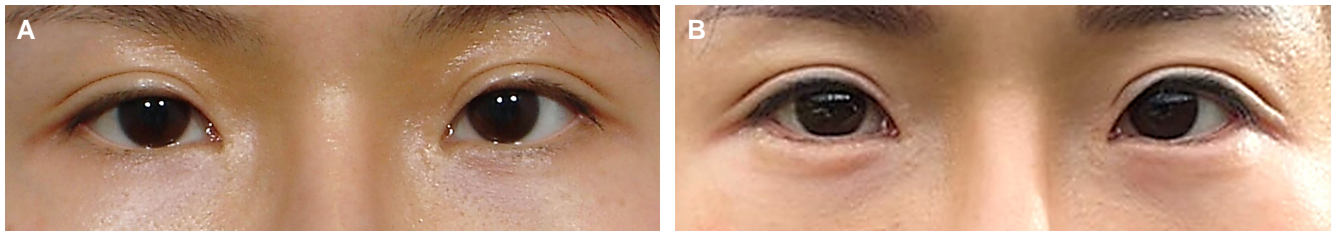
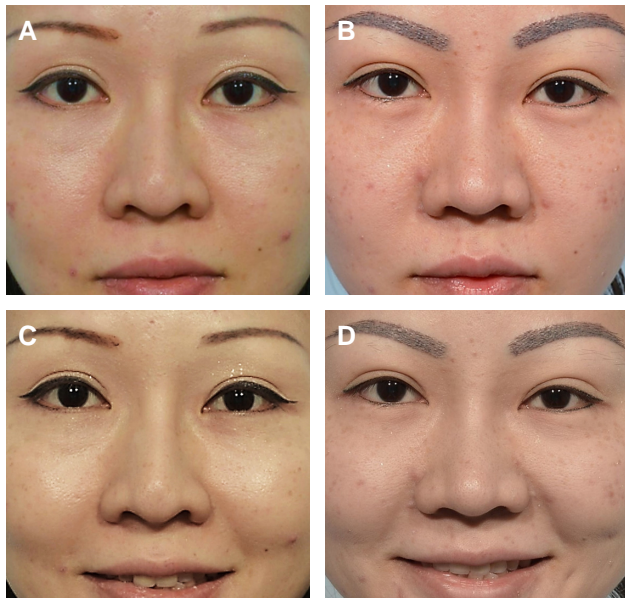
anatomical perspective. It is noteworthy that the pretarsal and preseptal OOMs are innervated by 5 to 7 terminal branches of the seventh cranial nerve, which approach the OOM fibers at an angle of $\sim 90^\circ$.⁸ The pretarsal portion of the OOM is responsible for various functions, including facilitating rapid involuntary blinking closure of the eye, maintaining eyelid closure during sleep, and shortening the canaliculi of the nasolacrimal duct system to expel tears into the lacrimal sac when the palpebral orbicularis muscle contracts.⁹

Pretarsal fullness is primarily caused by the hypertrophy of the pretarsal portion of the orbicularis oculi muscle, as described in a study on partial resection of the OOM in young patients undergoing blepharoplasties.¹⁰ However, preseptal orbicularis oculi muscle overriding the pretarsal orbicularis oculi muscle can also be a potential cause of pretarsal fullness.^{11,12}

To achieve optimal aesthetic outcomes, static pretarsal fullness should possess appropriate length, width, and projection. The width of static pretarsal fullness is reported to be

Table 1. Criteria of Aesthetic Evaluation

Scale	Description
Excellent	Apparent fullness, visible pretarsal crease (adequate width and projection)
Good (not troublesome)	Visible fullness with or without mild asymmetry
Fair (slightly troublesome)	Malposition or sagging or much less visible pretarsal crease
Poor (very troublesome)	Infection or extrusion

**Figure 7.** A 27-year-old female participant who underwent surgical implantation of 20 segments overlaid with fascia graft for the augmentation of her pretarsal area is shown: (A) preoperative and (B) 9-year postoperative, characterized by a roll-type static pretarsal fullness.**Figure 8.** The case of a 33-year-old female participant who underwent surgical implantation of 15 strips of 3-0 Gore-Tex (W. L. Gore & Associates, Inc.) sutures overlaid with fascia grafts for the augmentation of her pretarsal area. She is shown (A) preoperative and (B) 17 months postoperative, featuring a crescent-type static pretarsal fullness; and smiling (C) preoperative and (D) 17 months postoperative.

around 6.1 to 6.5 mm before the age of 40, which increases to around 7.5 mm after 50 years of age.¹ Moreover, the projection of static pretarsal fullness is reported ~ 1.4 to 1.6 mm^2 ,

and we recommend that the normal range of projection should be between 1.5 and 2 mm (Table 2).

Upon comparison of the physical properties of carved Gore-Tex sheet and Gore-Tex suture, it was found that the former exhibits greater rigidity and reduced pliability, making its insertion into the narrow pretarsal space challenging. To overcome this limitation, we opted to use multiple segments of 3-0 Gore-Tex suture inserted transversely in the subciliary region. This decision was based on the observation that Gore-Tex suture material is softer and more pliable, resembling the pretarsal OOM, and thus facilitates insertion into the limited subciliary space at the pretarsal zone. Further investigation into the pliability of smaller Gore-Tex sutures, such as 4-0, may be required to assess their potential use in future procedures.

According to previous reports, the average width of the tarsal plate in the lower eyelid of Asian individuals is 4.12 mm.¹³ Our own measurements show that the distance between the eyelash root and caudal margin of the tarsal plate is ~ 2.5 mm. To achieve optimal pretarsal fullness, it is recommended to use a 20-segment Gore-Tex bundle with a diameter of 2.5 mm to fit into the subciliary pretarsal space. However, for patients who prefer a smaller pretarsal fullness, a 15-segment bundle with a diameter of about 2.2 mm can also be used.

Initially, we used multiple segments of 3-0 Gore-Tex suture transversely implanted in the subciliary region because of its softness and pliability, which facilitated its fitting into the small subciliary space at the pretarsal zone. However, we noticed that some patients experienced skinny pretarsal

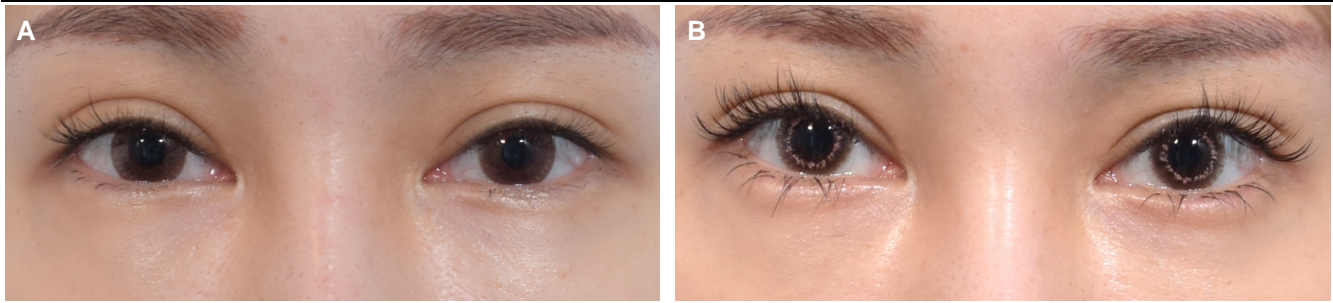


Figure 9. A 28-year-old female participant who underwent implantation of 15 strips of 3-0 Gore-Tex (W. L. Gore & Associates, Inc.) sutures overlaid with fascia grafts to enhance her pretarsal fullness. She is shown (A) preoperative and (B) 6 months postoperative, demonstrating a spread-out-type static pretarsal fullness.

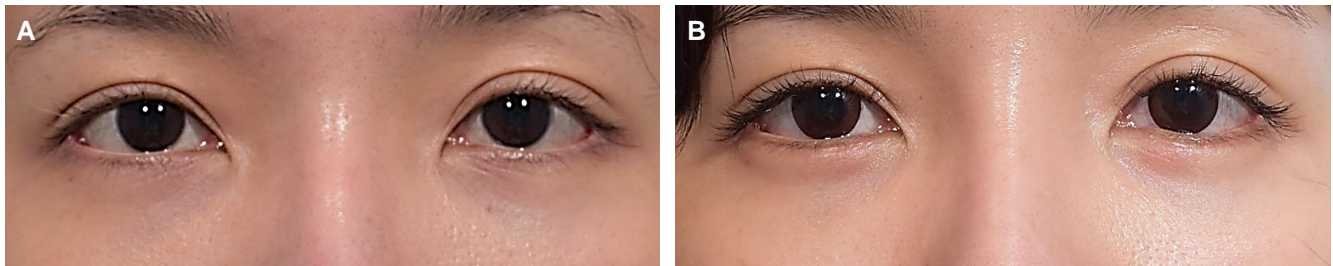


Figure 10. A 26-year-old female patient underwent surgical intervention wherein 16 segments of 3-0 Gore-Tex (W. L. Gore & Associates, Inc.) suture were implanted overlaid with fascia grafts to augment her pretarsal area. She is shown (A) preoperative and (B) 6 months postoperative, exhibiting a mixed-type static pretarsal fullness characterized by both crescent and roll types.

Table 2. Patient Profiles and Surgical Outcomes

Patient no.	Gender	Primary (1°) or secondary (2°)	Age	Gore-Tex strips no. (W. L. Gore & Associates, Inc., Flagstaff, AZ)	Fascia graft (FG) or megaderm (ADM)	Result	Follow-up time (month or year)	Postop pretarsal fullness (mm) (projection/width)
1	Female	1°	22	20	FG	Poor (infection) excellent after revision	10 yrs	2/7
2	Female	1°	27	20	FG	Good	9 yrs	NA
3	Female	1°	23	15	FG	Good	7 yrs	1.5/6.5
4	Female	2°	40	20	FG	Excellent	5 yrs	2/7
5	Female	1°	38	18	FG	Good	5 yrs	NA
6	Female	1°	25	16	FG	Excellent	5 yrs	1.5/5
7	Female	1°	22	20	FG	Good	3 yrs 6 m	1.75/5.5
8	Female	1°	22	20	FG	Good	2 yrs 7 m	NA
9	Female	2°	36	20	FG	Excellent	2 yrs 3 m	NA
10	Female	1°	33	15	FG	Excellent	1 yr 5 m	1.75/6
11	Female	1°	45	20	FG	Fair (malposition) good after revision	9 m	NA
12	Female	1°	28	15	FG	Good	6 m	NA
13	Female	1°	35	15	FG	Good	6 m	NA
14	Female	1°	32	15	FG	Excellent	7 m	NA
15	Female	1°	29	20	FG	Excellent	8 m	NA
16	Female	1°	26	15	FG	Excellent	6 m	NA

m, months; NA, not applicable; yrs, years.

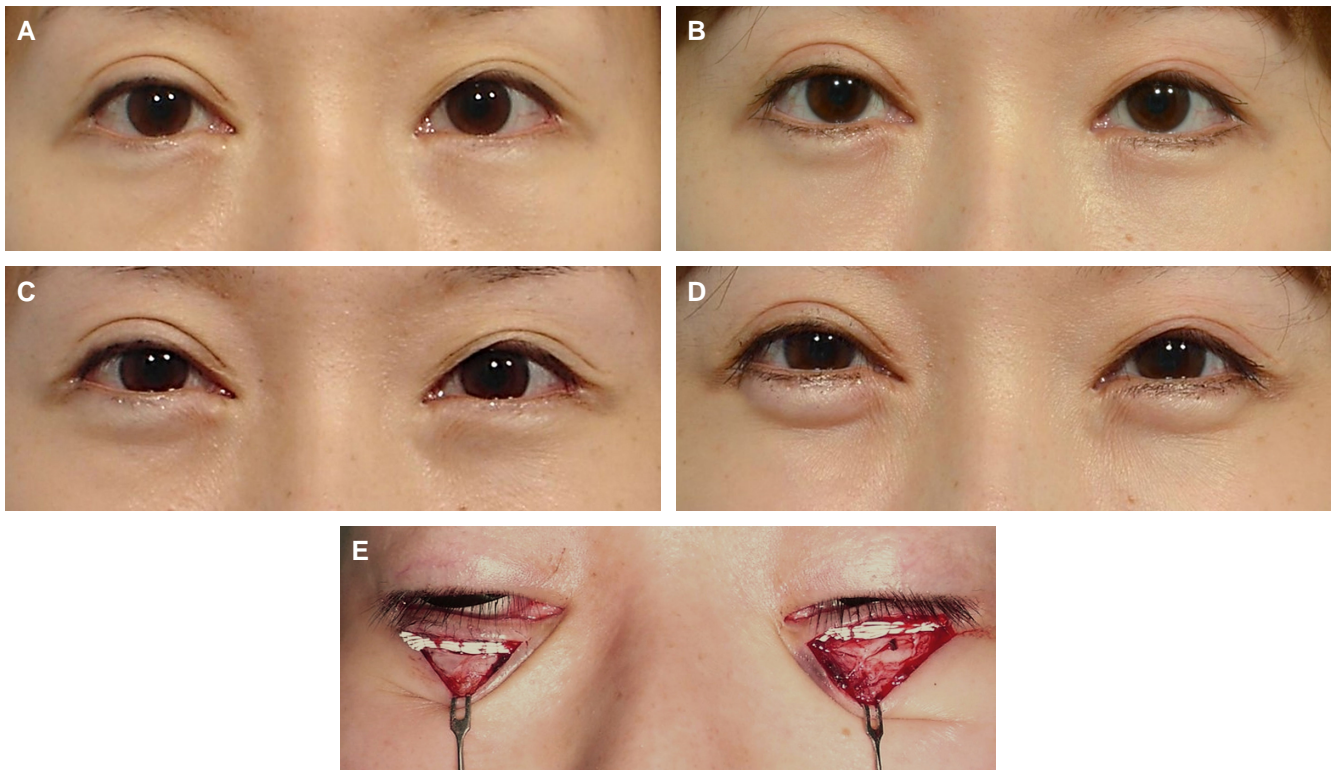


Figure 11. A 28-year-old female patient who underwent pretarsal augmentation with Gore-Tex (W. L. Gore & Associates, Inc.) pieces previously, which yielded unsatisfactory results in terms of pretarsal fullness, is shown: (A) preoperative and (B) 14 months postoperative; and smiling (C) preoperative and (D) 14 months postoperative. (E) Implantation of 15 segments of 3-0 Gore-Tex suture overlaid with fascia grafts.



Figure 12. The Gore-Tex (W. L. Gore & Associates, Inc.; Flagstaff, AZ) pieces that were removed from the 28-year-old female patient shown in [Figure 11](#).

fullness over time. The scenario resembles the occurrence of a skinny dorsum subsequent to nasal augmentation with an implant, which has been observed in certain patients with thin skin on their noses.¹⁴ To address this, we introduced a small piece of retroauricular mastoid fascia graft onto the implanted Gore-Tex segments to eliminate the potential skinny appearance and simultaneously enhance the projection of the pretarsal zone. This new technique has proved to be effective in creating static pretarsal fullness and achieving excellent long-lasting cosmetic outcomes.

The shape of the pretarsal fullness can be modified by adjusting the orientation of the implant during the implantation process. Specifically, positioning the long-beveled surface toward the caudal direction can result in a crescent-shaped fullness, while orienting it toward the inferior direction to the tarsal plate or the skin side and spreading it out can yield a spread-out type. Shortening the beveled distance to a minimum level can generate a roll-type fullness.

Furthermore, the placement of the approach incision is crucial, and we recommend using a subciliary full incision that closely resembles the incision used in traditional external lower blepharoplasty, which has produced favorable scarring outcomes. This approach allows for the

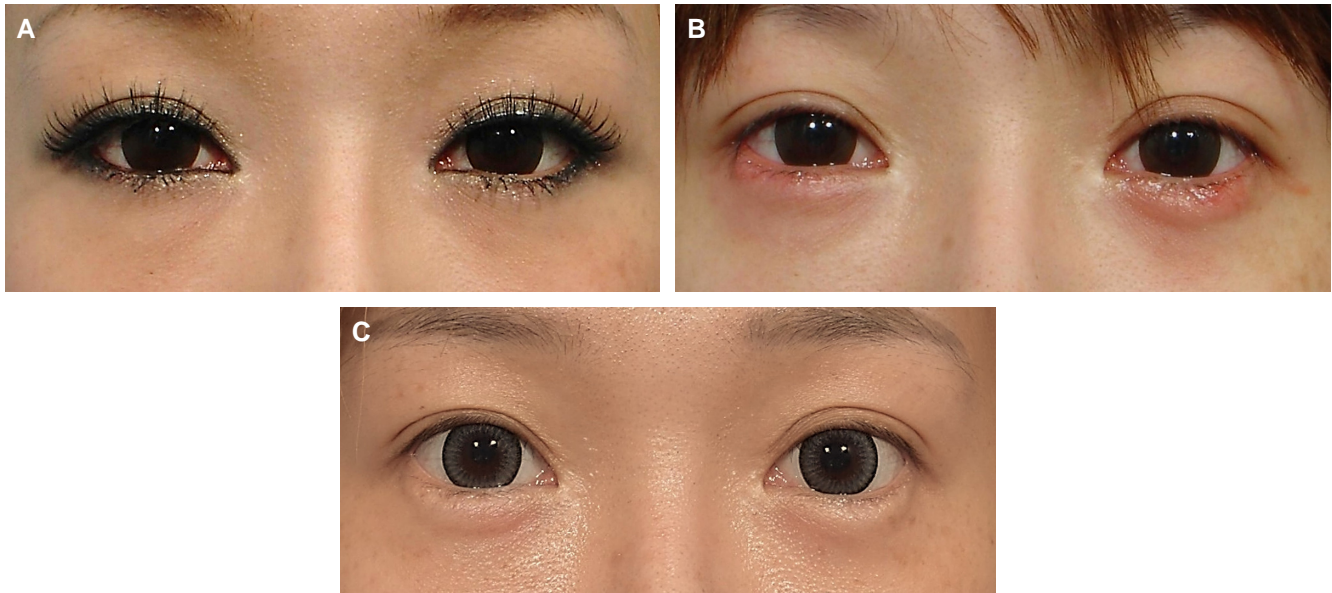


Figure 13. A 22-year-old female patient who underwent implantation of 20 segments of 3-0 Gore-Tex (W. L. Gore & Associates, Inc.) suture is shown: (A) preoperative and (B) 2 months after the initial operation when bilateral infection occurred, which was treated with antibiotics. Her right pretarsal swelling subsided. However, her left infected Gore-Tex bundle was removed strip by strip through a 3 mm incision at the lateral subciliary region. Two years later, the patient underwent a re-implantation of a 3-0 Gore-Tex suture bundle into her left pretarsal area. (C) Excellent results were achieved at the 10 years follow-up.

securement of the Gore-Tex suture bundle at the midpoint of the lower tarsal plate using multiple suture fixation.

Based on our clinical experience, we propose that ADM may be a promising alternative to fascia grafts for covering Gore-Tex suture implants. In light of our recent findings, we have expanded our use of ADM in conjunction with implant placement, rather than relying on mastoid fascia grafts. Our initial results using this new technique have been promising. In a preliminary study, we performed Gore-Tex suture implantation in patients who had received ADM augmentation of the pretarsal area. The outcomes were satisfactory, as the remaining ADM effectively covered the Gore-Tex suture implants. Therefore, we hypothesize that ADM may be a viable option for covering Gore-Tex suture implants in lieu of fascia grafts. However, further research is needed to validate this hypothesis. Regarding the potential complication of Gore-Tex suture granuloma,¹⁵ our long-term observation did not reveal any instances of this specific complication occurring.

Study Limitations

The present study had limitations due to a relatively small sample size. Therefore, our findings need to be confirmed by larger studies with longer follow-up periods.

CONCLUSIONS

We describe a novel approach to restore pretarsal fullness using a Gore-Tex suture implant covered with a

retroauricular mastoid fascia graft, effectively creating static pretarsal fullness with excellent permanent cosmetic results. The procedure is safe and provides long-lasting results.

Disclosures

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