Tarsal Sling: An Essential Stitch to Prevent Scleral Show in Lower Blepharoplasty

Aesthetic Surgery Journal
2015, Vol 35(1) 11–19

DOI: 10.1093/asj/sju018
www.aestheticsurgeryjournal.com
OXFORD UNIVERSITY PRESS

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Abstract

Background: Despite its popularity for facial rejuvenation, blepharoplasty has been associated with several adverse effects. One of the most common is eyelid displacement after lower transcutaneous blepharoplasty. The tarsal sling procedure affixes the external portion of the septum (the lateral canthal ligament) to the internal orbital wall periosteum with a simple suture. This simplified canthopexy decreases the risk of lower eyelid margin displacement.

Objectives: The authors sought to determine the effectiveness of the tarsal sling technique in preventing lower eyelid malposition.

Methods: A retrospective analysis of 40 consecutive patients was conducted. Twenty patients underwent standard blepharoplasty (group 1), and 20 underwent blepharoplasty plus tarsal sling support (group 2). Pre- and postsurgical positions of the lower eyelid margin were compared by quantitative analysis of measurements obtained from clinical photographs.

Results: Postoperatively, reduction of scleral appearance was noted for group 2. Although progressive recovery occurred in this group by 2 years postoperative, the lower eyelids did not revert to presurgical position, and a slight degree of overcorrection remained. The overcorrection was minimal, without unpleasant consequences for the patients. In contrast, group 1 patients experienced an increase in the distance between the interpupillary line and the lateral aspect of the lower eyelid margin after blepharoplasty. Although progressive resolution of scleral show occurred by 2 years postoperative, recovery was not complete.

Conclusions: Through quantitative analysis, the authors demonstrated the effectiveness of a simplified canthopexy procedure. Tarsal sling is an easy, quick, and efficacious procedure to prevent eyelid malposition after lower blepharoplasty.

Level of Evidence: 4

Accepted for publication May 13, 2014.

Well-balanced volumetric distribution of midface soft tissue is essential for a youthful appearance. In young individuals, the eyelid-cheek complex appears as a single, smooth, convex surface.[1] However, this region changes substantially with aging. Blepharoplasty is a common procedure to promote functional and cosmetic improvement of the periorbital and midfacial areas, in turn improving the patient's self-image.[2-4]

Despite its popularity, blepharoplasty has been associated with various complications and adverse outcomes.[5,6] A common complication of lower blepharoplasty is malposition of the lower eyelid, which may manifest as lack of definition of the lateral part of the eyes, rounding of the scleral triangle, eyelid retraction, scleral show and ectropion, and/or

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symptoms of ocular irritation.[7] Many of these effects can result in long-term functional problems; therefore, it is crucial that surgeons focus not only on fat and skin but also on restoration of eyelid tone—which should be the primary consideration in lower blepharoplasty.[8]

Several presurgical anatomic methods for detecting tarsoligamentous laxity have been described, including the distraction test and snap test. Preexisting negative canthal tilt and prominent eyes are among the criteria for preventive lateral canthal support.[9] Tarsoligamentous laxity is most common in older patients, who have a higher risk for extreme laxity. However, some data have shown that even young patients with normal eyelid position and good results on the eyelid snap test may develop rounding of the lower eyelid after blepharoplasty.[10]

The tarsal sling technique is a simple plication of the lateral part of the paracanthal portion of the orbital septum[11,12] that may avert lower eyelid displacement after blepharoplasty. The aim of this study was to determine the efficacy of the tarsal sling technique in preventing lower eyelid malposition.

METHODS

Patients

This was a retrospective analysis of 40 consecutive healthy patients who underwent upper as well as lower blepharoplasty to both eyes. All operations were performed between January 2009 and December 2011 by the same surgeon (M.P.). Informed consent was obtained from each patient preoperatively. Institutional Review Board approval was not required because the research involved collection of existing data, and patients remained anonymous throughout the study. Upper blepharoplasty was performed according to standard technique.[11] Group 1 comprised 20 patients who underwent standard lower blepharoplasty without additional canthal support, and group 2 comprised 20 patients who underwent lower blepharoplasty and tarsal sling canthopexy. Utilization of the tarsal sling technique was based on the date of surgery. In 2009, we performed blepharoplasty without canthopexy in patients who had no apparent pathologic eyelid laxity. Beginning in 2010, canthopexy became routine in all cases, even when there was no apparent risk of postsurgical eyelid displacement.

A complete presurgical ophthalmologic examination was performed for all patients, including a palpebral evaluation focusing on the position and tension of the lower eyelid in relation to prominence of the eye globe. The assessment began with observation. The symmetry of the lower eyelids was assessed, and each lid was examined with respect to position, width, and medial and lateral canthal tension.

Patients with horizontal laxity, proptosis, preexisting scleral show, or negative midfacial vector were not included in the study. The degree and location of eyelid weakness were ascertained by an eyelid distraction test, in which the eyelid is distracted inferiorly. If the eyelid could be distracted >10 mm from the eye globe, and the time to return to normal position was >2 seconds, the result of the distraction test was considered positive, indicating the presence of horizontal laxity. None of the 40 patients demonstrated pathologic eyelid laxity. Medial canthal tendon laxity was assessed clinically by distracting the lower lid laterally and observing the position of the inferior punctum. Lateral displacement of the punctum by more than 2 mm was not observed in any patient. Lateral canthal tendon laxity was tested by distraction of the lower eyelid medially, and movement was <2 mm in all cases.

Surgical Technique

Lower eyelid procedures were performed through an external transcutaneous approach. A standard subciliary incision was made approximately 2 mm below the ciliary margin, and a skin flap was elevated, leaving the pretarsal orbicularis intact over the septum. The muscle was incised at the inferior aspect of the tarsus and converted to a skin-muscle flap, and preseptal dissection proceeded downward to the orbital rim. After release of the anterior lamella, orbital fat was conservatively removed, preserved, or repositioned according to the patient's individual requirements.

For traditional lower blepharoplasty (group 1), excess skin and part of the orbicularis oculi were excised. In most cases, removal of 1 to 2 mm of orbicularis and 2 to 5 mm of skin was sufficient. In all lower blepharoplasties, great care was taken to avoid overresection of eyelid skin.

Patients in group 2 underwent a lateral simplified canthopexy by plication of the canthal ligament. After release of the palpebral septum by dissection below the orbicularis, its paracanthal portion or canthal ligament was fastened and fixed to avoid detachment, without exposing the canthal tendon. The canthal ligament was sutured to the lateral orbital rim periosteum (with 5-0 Prolene sutures [Ethicon, Somerville, NJ] on a half-circle P-2 needle), as internally as possible, by passing through the upper eyelid incision (Figure 1A-C). This suture was fixed through the periosteum inside the lateral orbital rim to maintain the relationship between the lid and the globe. The most common vertical placement of the lateral canthopexy suture was at the lower level of the pupil, but patients with prominent eyes or negative vector required additional vertical positioning of the lateral canthal support suture at the level of the upper border of the pupil. After the canthopexy procedure, we ensured that the upper margin of the lower eyelid was at 1 to 2 mm above the limbus, followed the contour of the globe, and did not distract >2 mm from the globe.

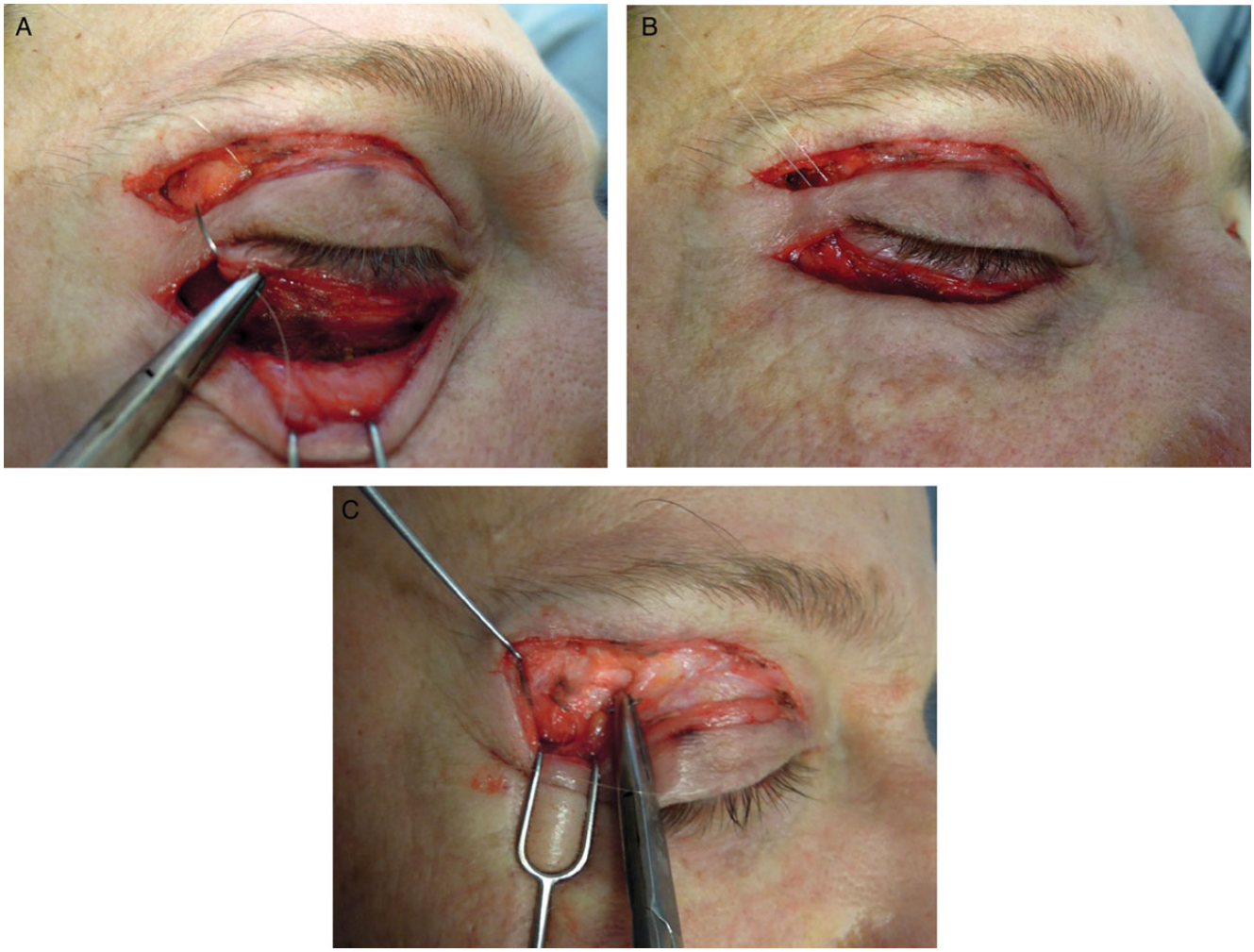

Figure 1. This 55-year-old woman underwent lower blepharoplasty with the tarsal sling technique. (A) The suture was passed through the canthal ligament in the lateral aspect of the septum. Fibers of the orbicularis oculi and/or the tendon were occasionally incorporated into the suture. (B) The suture was pulled through the upper eyelid breach to exert backward tension on the lower eyelid. (C) The suture was then anchored within the lateral orbital wall to maintain the posterior position of the eyelid margin against the eye globe.

Photometric Evaluation

Four to 6 weeks preoperatively, full-size, 1:1 standardized photographs (Frankfurt horizontal plane) were taken of each patient. Position, facial expression, focal distance, and camera settings were standardized. Additional photographs were obtained postoperatively at 30 days, 6 months, 1 year, and 2 years, and eyelid position was measured on these photographs. All photographs were sized with Adobe Photoshop CC (Adobe Systems Inc, San Jose, CA) to ensure that initial proportions were maintained. Linear measurements were obtained with Adobe Illustrator CC after a blue interpupillary line was drawn. The distance (in millimeters) between this line and the lower eyelid margin was registered by tracing and measuring a red line (perpendicular to the blue one) that was tangential to the lateral part of the limbus (Figure 2). For all patients, measurements were obtained and documented by the same physician (L.B.).

Statistical Analysis

All data were reported in an Excel file (Microsoft, Redmond, WA), and statistical analyses were performed with SPSS software (SPSS Inc, Chicago, IL). A paired sample test was performed on the data for each study group, and the results were utilized to determine between-group differences in lower eyelid position for the following periods: preoperative to 30 days postoperative, 30 days to 6 months postoperative, 6 months to 1 year postoperative, and 1 year to 2 years postoperative.

Figure 2. Measurements were obtained at 5 time points for each patient: preoperative and at 30 days, 6 months, 1 year, and 2 years postoperative. The distance (in millimeters) between the interpupillary line (blue line) and lower eyelid margin on the perpendicular tangent of the lateral part of the limbus (red line) was measured for each eye.

Table 1. Group 1: Distance Between Interpupillary Line and Lower Eyelid Margin

Time of Photograph	No. of Eyes	Distance Between Interpupillary Line and Lower Eyelid Margin (mm)			
		Minimum	Maximum	Mean	SD
Preoperative	40	3.70	12.70	7.19	2.19
Postoperative					
30 d	40	4.59	16.80	9.56	2.97
6 mo	40	4.41	15.52	9.13	2.63
1 y	40	4.70	13.20	8.77	2.48
2 y	40	4.85	14.10	8.59	2.51

Group 1 patients underwent blepharoplasty without tarsal sling canthal support. SD, standard deviation.

Table 2. Group 2: Distance Between Interpupillary Line and Lower Eyelid Margin

Time of Photograph	No. of Eyes	Distance Between Interpupillary Line and Lower Eyelid Margin (mm)			
		Minimum	Maximum	Mean	SD
Preoperative	40	4.50	13.97	8.70	2.53
Postoperative					
30 d	40	3.50	10.76	6.89	1.77
6 mo	40	4.67	11.10	7.73	1.81
1 y	40	4.70	11.96	8.16	1.93
2 y	40	4.76	12.48	8.59	2.07

Group 2 patients underwent blepharoplasty with tarsal sling canthal support. SD, standard deviation.

RESULTS

Group 1 (standard lower blepharoplasty without tarsal sling) consisted of 18 women and 2 men, with a mean age of 50 ± 6 years at the time of surgery. Group 2 (lower blepharoplasty with tarsal sling) comprised 17 women and 3 men, with a mean age of 54 ± 9 years. All patients completed follow-up through 2 years.

Distances between interpupillary lines and lower eyelid margins for groups 1 and 2 at all time points are listed in Tables 1 and 2, respectively. Pairwise comparisons of measurements at follow-up time points are listed in Tables 3 and 4. Blepharoplasty without tarsal support resulted in eyelid malposition, with progressive spontaneous recovery after the immediate postsurgical time point through the end of the first year (Table 3), after which time the results did not change. Statistical comparison of mean values for each time interval was performed to identify when surgical results became stable (ie, no statistical difference between 2 time points). The only comparison with statistical significance was year 1 vs year 2, indicating that surgical results were stable by 1 year.

The tarsal sling procedure resulted in reduced scleral exposition in the immediate postoperative period, but recovery occurred over the subsequent 2 years (Table 4). By the 2-year follow-up, the distance between the interpupillary

Table 3. Group 1: Pairwise Comparisons of Scleral Show Between Time Points

Time of Photograph	Pairwise Comparisons of Scleral Exposition Between Time Points (mm)					*t*	*df*	2-Tailed *P* Value
	Mean Change	SD	SEM	95% CI				
				Lower	Upper			
Preoperative to 30 d postoperative	+2.364	1.987	0.314	+1.729	+2.999	+7.527	39	.000
30 d to 6 mo postoperative	−0.428	0.989	0.156	−0.112	−0.744	−2.740	39	.009
6 mo to 1 y postoperative	−0.356	0.796	0.126	−0.110	−0.614	−2.825	39	.007
1 y to 2 y postoperative	−0.184	0.616	0.097	−0.013	+0.381	−1.887	39	.067

Group 1 patients underwent blepharoplasty without tarsal sling canthal support. Eyelid malposition was evident in the early postoperative period, with progressive spontaneous recovery through 1 year postoperative. There was no significant change from year 1 to year 2. CI, confidence interval; *df*, degrees of freedom; SD, standard deviation; SEM, standard error of the mean.

Table 4. Group 2: Pairwise Comparisons of Scleral Show Between Time Points

Time of Photograph	Pairwise Comparisons of Scleral Exposition Between Time Points (mm)					*t*	*df*	2-Tailed *P* Value
	Mean Change	SD	SEM	95% CI				
				Lower	Upper			
Preoperative to 30 d postoperative	−1.818	1.282	0.203	−2.228	−1.407	−8.964	39	.000
30 d to 6 mo postoperative	+0.848	0.624	0.099	+1.048	+0.649	+8.593	39	.000
6 mo to 1 y postoperative	+0.428	0.559	0.088	+0.606	+0.249	+4.843	39	.000
1 y to 2 y postoperative	+0.430	0.478	0.076	+0.582	+0.277	+5.692	39	.000

Group 2 patients underwent blepharoplasty with tarsal sling canthal support. In the first postsurgical period, scleral exposition was overcorrected; however, at each subsequent time point, the position of the lid became closer to the preoperative position. CI, confidence interval; *df*, degrees of freedom; SD, standard deviation; SEM, standard error of the mean.

line and lower eyelid had recovered almost completely. In group 2, the mean distance between the interpupillary line and lower eyelid margin was 8.7 mm preoperatively and 8.59 mm at 2 years postoperatively (Table 2). For group 1 patients, a statistically significant difference was noted between years 1 and 2, indicating that the scleral show underwent spontaneous recovery but did not disappear completely by the second year. However, the difference between presurgical and final eyelid position at 2 years, without tarsal support, was approximately 20% (Table 1). In group 1, the mean presurgical distance of 7.19 mm increased to 8.59 mm by 2 years postoperative.

Figure 3 depicts the differences in postsurgical measurements between groups 1 and 2. Group 2 patients showed overcorrection of potential caudal retraction of the lower eyelid and consequent overcorrection of scleral exposition in the immediate postoperative period. Progressive relapse and increased scleral exposition occurred over the following 2 years, but presurgical eyelid positions were not attained, and a slight overcorrection remained. Immediately after surgery, the distance between the interpupillary line and the lateral aspect of the lower lid margin increased in group 1 patients. Progressive reduction in scleral exposition followed, but recovery was not complete.

Figures 4 and 5 demonstrate clinical results for a patient treated without and with the tarsal sling procedure, respectively. Presurgical and 2-year measurements were compared to detect significant differences between the surgical techniques. Table 5 is a cross-tabulation of Tables 1 and 2. The comparison between presurgical measurements and type of surgery is depicted in Table 6. The only statistically significant difference was casually related to the group. In fact, patients treated with blepharoplasty alone, had a shorter distance between the interpupillary line and the lower lateral eyelid margin. Although these patients had potentially better (higher) lower eyelid position before surgery, final outcomes did not differ between the study groups, indicating that tarsal sling canthopexy enhanced the surgical outcomes.

DISCUSSION

Eyelid tone and position have been the most common limiting aspects of transcutaneous lower blepharoplasty. Dysfunction of the lateral canthal tendon can be caused by aging, iatrogenic damage, and other reasons. Lower eyelid retraction may result from dynamic imbalance in the lateral suspension system of the lower eyelid, lack of

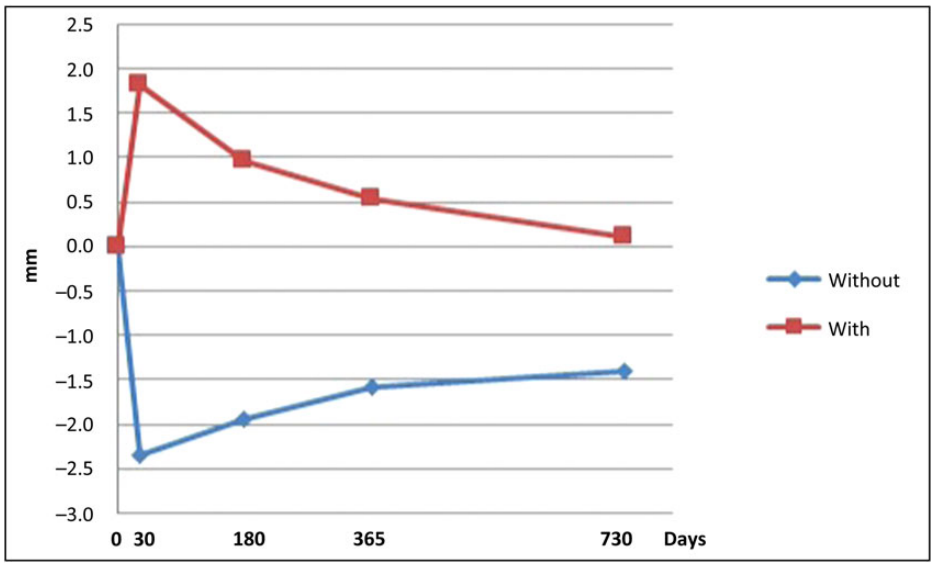

Figure 3. Mean differences in pre- and postoperative eyelid positions after 30 days, 6 months, 1 year, and 2 years in patients treated with (red) and without (blue) the tarsal sling procedure.

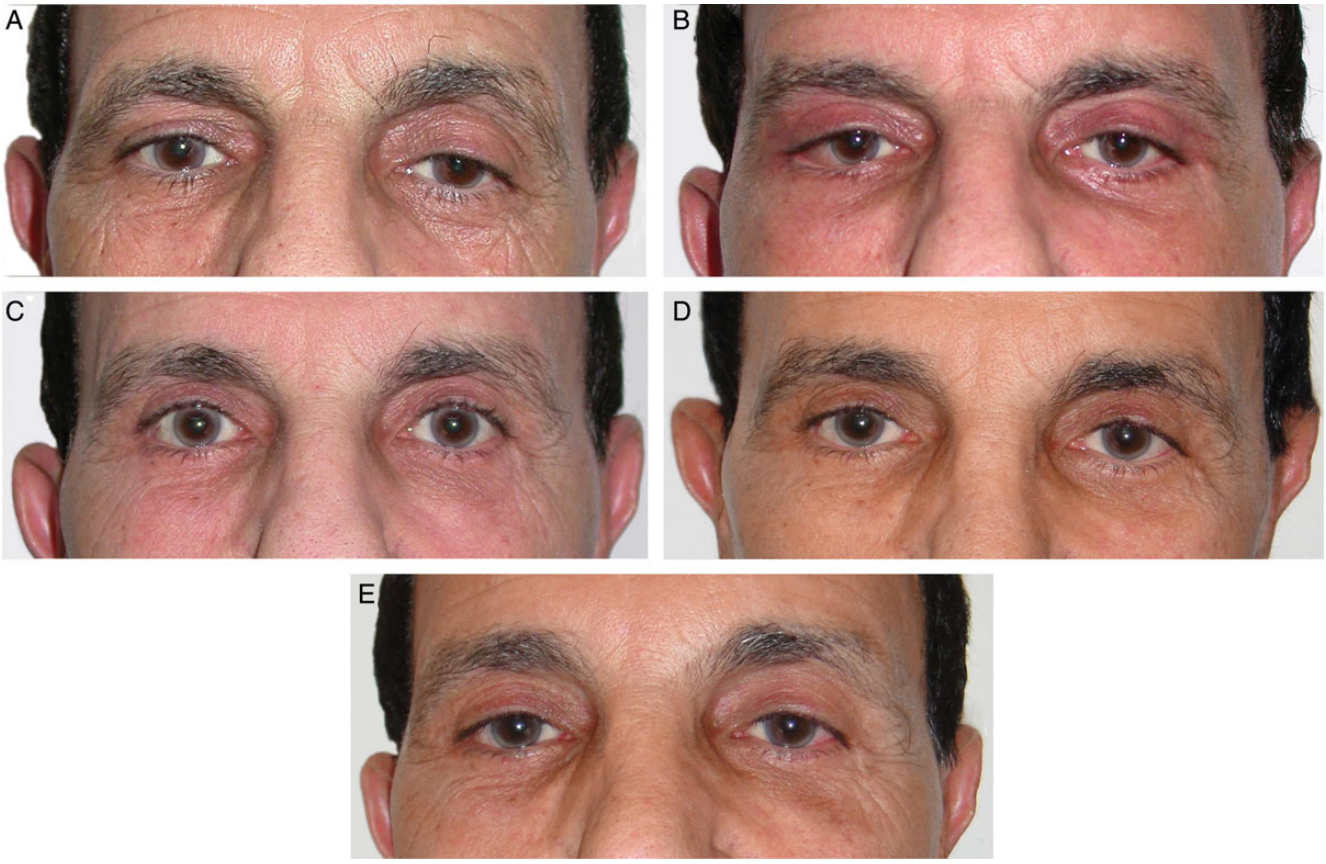

Figure 4. This 53-year-old man underwent blepharoplasty without the tarsal sling technique to improve periocular roughness and upper eyelid asymmetry: (A) before standard blepharoplasty, (B) 30 days postoperative, (C) 6 months postoperative, (D) 1 year postoperative, and (E) 2 years postoperative. No functional or aesthetic complaints were reported by the patient.

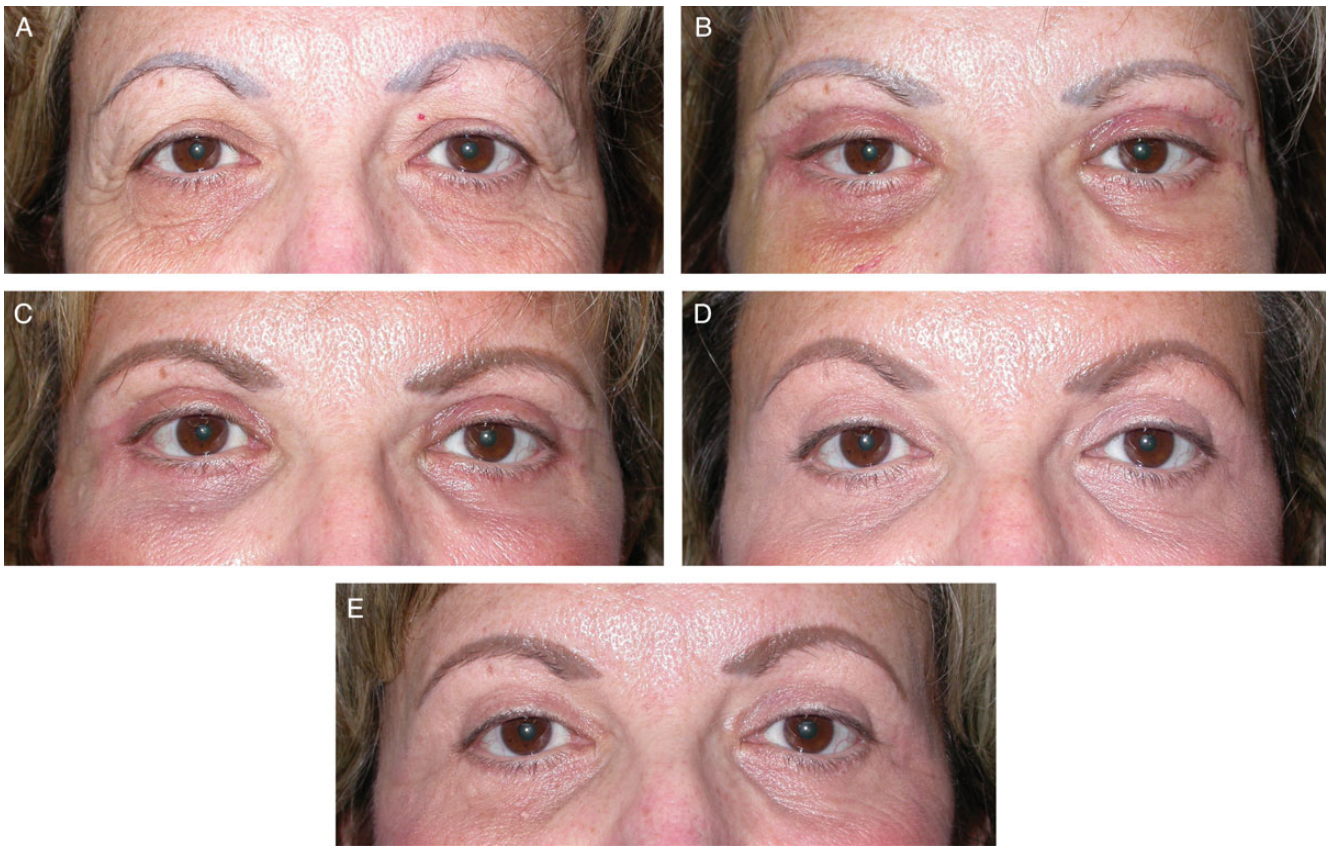

Figure 5. This 56-year-old woman underwent blepharoplasty with the tarsal sling technique to improve her appearance: (A) before blepharoplasty with tarsal sling, (B) 30 days postoperative, (C) 6 months postoperative, (D) 1 year postoperative, and (E) 2 years postoperative. No functional or aesthetic complaints were reported by the patient.

elasticity of midfacial soft tissue, and postsurgical scarring due to scarring of the orbital septum and posterior lamella. Scarring occurs from shortening of the skin-muscle layer to the point that it overrides the elasticity of the tarsoligamentous sling. This can occur in a vertical plane when the eyelid is distracted downward, resulting in scleral show, or in a horizontal plane by turning the lid outward, which causes ectropion.[13]

Motor denervation of the pretarsal orbicularis oculi after a transcutaneous approach also may result in eyelid laxity.[14] Some authors suggest that extra eyelid support in lower blepharoplasty is not always necessary; they consider rounding of the scleral triangle to be a cosmetic complaint only.[15]

Conservative surgical efforts to prevent eyelid malposition in lower blepharoplasty may limit the ability to strengthen the anterior lamella and correct skin or muscle excess. Although it has been suggested that eyelid malposition may be less common with the transconjunctival approach, additional procedures (such as laser resurfacing) may be required to reduce wrinkling.[16] Moreover, retrobulbar hematoma (a significant complication that can lead to amaurosis) has occurred more frequently with this approach.

Intraoral access has been proposed to avoid complications resulting from interference with key anatomic structures of the lower eyelid.[17] Although useful for repositioning lower eyelid fat when combined with midface elevation and fixation to the deep temporal fascia, the intraoral approach may require an additional pinch lower blepharoplasty to remove excess skin.[17]

It has been demonstrated that lower eyelid position and tone are highly dependent on the tarsoligamentous complex, consisting of the medial and lateral canthal tendons and the fibrous tissue of the tarsal plate.[18] Laxity increases in aging tissue because the lateral canthal tendon has weakened, not because the tarsus has lengthened.[18]

Almost all lower blepharoplasties are aimed at preserving pretarsal fibers of the orbicularis (anterior lamella), but preservation of the posterior lamella is not always a goal. The purpose of this study was not to present the tarsal sling as a new technique, but rather to quantify its effectiveness. In our experience, this stitch is a common technique. Fagien[19] has described retinacular suspension, which is similar but involves deeper structures near the lateral canthal tendon. “Tarsal sling” emphasizes the importance of engaging the

Table 5. Group 1 vs Group 2: Distance Between Interpupillary Line and Lower Eyelid Margin (mm) Preoperative and 2 Years Postoperative

Procedure Group	Preoperative	2 Years Postoperative
Group 1 (n = 40 eyes)		
Mean	7.194	8.591
SD	2.168	2.506
Group 2 (n = 40 eyes)		
Mean	8.699	8.587
SD	2.533	2.070
Total (N = 80 eyes)		
Mean	7.946	8.589
SD	2.462	2.284

Although group 1 had significantly better (higher) lower eyelid position preoperatively, their 2-year outcomes were similar to those of group 2. This suggests that tarsal sling canthopexy enhanced aesthetic outcomes. SD, standard deviation.

Table 6. Analysis of Variance: Preoperative vs 2-Year Postoperative Measurements

	Sum of Squares	*df*	Mean Square	*F*	*P* Value
Preoperative					
Between groups (combined)	45.255	1	45.255	8.142	.006
Within groups	433.522	78	5.558		
Total	478.777	79	—		
2 years postoperative					
Between groups (combined)	0.000	1	0.000	0.000	.994
Within groups	412.166	78	5.284		
Total	412.167	79	—		

Although group 1 had significantly better (higher) lower eyelid position preoperatively, their 2-year outcomes were similar to those of group 2. *df*, degrees of freedom.

natural orbit retentive system: the septum, which is anatomically continuous with the orbital periosteum and is a more superficial structure. Treatment of the orbital septum is straightforward, and this preventive support can easily be executed routinely.

The common goal of many canthopexy techniques is to fix the supporting eyelid anatomic structure (canthal tendon, lateral retinaculum, tarsal plate, canthal ligament, orbicularis) directly to the orbital periosteum or to a drill hole in the orbital frame. This attachment can be accomplished with or without interruption of the lateral canthus or by combining cantholysis and canthopexy. For example, in the tarsal strip procedure, a tongue of tarsus is dissected and lifted up after release of the lower portions of the lateral canthus.[20]

The tarsal sling technique avoids partial or total interruption of canthal structures and violation of the posterior lamella, which always occurs when the tarsus is dissected from the conjunctiva. The structures most involved in the tarsal sling technique are the canthal ligament and the septum, not the canthal tendon and tarsus. Anatomically, the orbital septum is continuous with the orbital periosteum. The canthal tendon is reinforced with procedures involving the surrounding supporting structures, hence the term "sling." This term was used by Tenzel[21] in regard to the canthus in the treatment of lagophthalmos, but the technique he described was a form of canthoplasty.

The tarsal sling is a canthal support procedure that acts only on the middle lamella; tendon excision and weakening are avoided. The location of the canthal ligament (immediately below the orbicularis and above the canthal tendon) allows for simple plication, which is easier for the surgeon and less invasive for the patient.

In this study, the distance between the interpupillary line and lower eyelid margin was measured tangential to the lateral part of the limbus. Slight differences in gaze, either upward or downward, can affect the position of the lower eyelid. Although we standardized the photographs, a craniostat was not used to fix the head position, which made it possible to reproduce the primary gaze in all images. Moreover, no patient in our study had any clinical sign of risk for malposition, such as excessive lid laxity, proptosis, or negative vector. When such risk is present, additional canthopexy or canthoplasty procedures are mandatory.

Our data demonstrate that the tarsal sling procedure is effective in preventing lower eyelid malposition. Moreover, it requires only a few minutes of operating time. It may be applied routinely to lower blepharoplasty as a preventive measure, even if eyelid tone appears normal preoperatively.

Although other techniques to correct or prevent extreme eyelid laxity should not be abandoned, we have demonstrated the effectiveness of a simplified canthopexy by quantitative comparison. This canthopexy is utilized by many surgeons,[22] with small variations in technique. Longer follow-up and a larger sample size are warranted to more completely evaluate surgical outcomes and statistical results.

CONCLUSIONS

Through quantitative analysis, the authors demonstrated the effectiveness of a simplified canthopexy procedure. The tarsal sling is a quick and easy technique to prevent eyelid malposition after lower blepharoplasty. It may be applied routinely to lower blepharoplasty cases, even if eyelid tone appears normal preoperatively. Additional studies, with longer follow-up periods, are warranted to confirm the findings.

Disclosures

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Funding

The authors received no financial support for the research, authorship, and publication of this article.

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