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The *tarsal belt* procedure for the correction of ectropion: description and outcome in 42 cases

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ABSTRACT

Background/aims Ectropion correction is a challenge in plastic surgery. Correction of the lower lid area, including restoration of the shape and position of lid margin, is the surgical goal. In this study, we describe a new surgical technique, the *tarsal belt*, for the correction of ectropion and evaluation of the effective outcome and complications of this procedure.

Methods Between January 2008 and January 2012, a total of 42 patients aged between 48 and 75 years (average age 61.5 years) were treated with this technique. This procedure consists in a trans-tarsal mattress non-absorbable suture anchored to the periosteum of the lateral orbital rim, combined with a small wedge excision of a lateral portion of the tarsus close to the lateral canthal tendon. During the same period, 66 patients were treated with the standard lateral tarsal strip technique. Preoperative and postoperative Ectropion Grading Scale (EGS) was recorded to evaluate anatomical improvement. The average follow-up period was 24 months.

Results Rate of success was 100% for involutional and cicatricial ectropions, 90% for lid retraction and 87.5% for paralytic ectropions. Anatomical success according to EGS scale was obtained in 41 patients. Recurrence of ectropion occurred in only one patient 6 months after the first surgery and required a further operation with a larger posterior lamella resection and new *tarsal belt* suture.

Conclusions The *tarsal belt* seems to be effective to correct the horizontal and vertical instability of the lid. The suture supports the lower eyelid along the entire tarsal plate length and corrects the outward buckling of the tarsal plate.

INTRODUCTION

Palpebral ectropion is an abnormality of the palpebral position characterised by an eversion of the eyelid-free edge. Ectropion may be congenital or acquired, and the acquired type encompasses involutional, cicatricial, mechanical and paralytic ectropions. The causes of ectropion may be different and often combined. Slackened tissue is responsible for hypotonic ectropions (involutional and paralytic forms), while a tissutal retraction is responsible for cicatricial ectropions.[1] Whatever the cause, the correction of ectropion requires a surgical approach as first-line therapy.

Numerous surgical techniques have been proposed in this regard.[2] Nonetheless, correction of ectropion remains surgically challenging because it requires the association of different surgical procedures, each of which has its own advantages and drawbacks.[3] For these reasons, oculoplastic surgeons explore alternative procedures, as the accepted standard for the correction of ectropion has not yet been well established.

In the present study, we introduce the *tarsal belt* technique as a simple, safe and effective procedure for the correction of ectropion. The focal point of the technique is a double mattress non-absorbable suture, simultaneously imbricating the inferior tarsal plate and the lateral canthal ligament to the lateral orbital rim, associated with a small wedge resection of the posterior lamella.

PATIENTS AND METHODS

Between January 2008 and January 2012, 42 patients with monolateral or bilateral ectropion (a total of 51 eyes) aged between 48 and 75 years (average age: 61.5 years) were treated using the *tarsal belt* technique (table 1). During the same period, 66 patients (96 eyes) aged between 44 and 80 years (average age 58.4 years) were operated with the standard lateral tarsal strip (LTS) technique (table 2).

This study was undertaken to evaluate the effectiveness and complications of the *tarsal belt* for the correction of ectropion as compared to the LTS technique. The study was approved by the local research ethics committee and informed consent was obtained before the surgical procedure and digital image production.

Both procedures were used to treat different types of ectropions, including involutional, lid retraction after lower lid blepharoplasty, paralytic and cicatricial ectropions (tables 1 and 2).

The postoperative follow-up ranged from 16 to 36 months (average 24 months).

Preoperative evaluation

All patients underwent a complete ophthalmological examination, including palpebral evaluation concerning the position and tension of the lower lid in relation to the eye globe. This assessment started with the evaluation of the symmetry of the lower eyelids, related to the position and width of medial and lateral canthal tension. Subsequently, the snap-back test,[4] the pinch test[5] and the distraction test[4] were executed to characterise lid laxity in three directions (vertical, horizontal and sagittal). The presence of ectropion of the lacrimal punctum, abnormalities of the eyelid, conjunctival scars and other deformities of the shape of the lid margin were carefully evaluated to exclude those cases where additional procedures were needed.

The grade of ectropion severity was assessed with the Ectropion Grading Scale (EGS) introduced by Moe and Linder[3] (table 3).

Before and after surgery, standard photographic documentation was obtained from all patients, with a central gaze in a sitting position.

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Table 1 Description, type of ectropion and rate of success of patients operated with the *tarsal belt* technique

Type of ectropion	Monolateral		Bilateral		Number (%)	Rate of success (%)
	Male	Female	Male	Female		
Involutional	0	3	6	0	9 (21.4)	100
Lid retraction	4	3	1	2	10 (23.8)	90
Paralytic	10	6	0	0	16 (38.2)	87.5
Cicatricial	3	4	0	0	7 (16.6)	100
Total	33		9		42	

Surgical technique

The procedure was performed under local anaesthesia achieved with infiltration of 7–10 mL of an anaesthetic solution into the lower lid, the lateral canthal region and lateral orbital rim. The anaesthetic solution was prepared as follows: 20 mL lidocaine (2%)+epinephrine (1:100.000), 10 mL bupivacaine (0.5%) dissolved in 70 mL of saline solution and 4 mL of sodium bicarbonate. Topical anaesthetic drops (Novesine, Novartis International AG, Switzerland) were added to the conjunctival fornix.

The lid incision was made along the grey line, 2–3 mm laterally to the inferior lacrimal punctum as far as 2–3 mm beyond the lateral canthus. To favour the dissection of the anterior to the posterior lamella of the lid, several traction sutures (6/0 Prolene) were made along the lower lid margin. The dissection was then carried out posteriorly to the pretarsal orbicularis muscle up to the inferior margin of the tarsal plate to expose the area of the orbital septum and lower lid retractors.

The dissection was extended to the inferior orbital rim using Westcott scissors.

A Colorado electrocautery needle was used for haemostasis. During this time, in case of cicatricial ectropions, the fibrous adhesions of the tissues were gently dissected when necessary. When the anterior surface of the tarsus was well exposed in all its extension, a mattress non-absorbable suture (6/0 Novolene) was passed twice through the tarsus. The suture was passed through the tarsus close to the lacrimal punctum in a vertical direction to define the distance between the superior and inferior passages of the double mattress sutures (figure 1A). This step defines the height of the belt (about 1.5 mm) that will support the lid suspension.

Subsequently, two mattress passages of the suture (superior and inferior passages) were carried out horizontally in a lateral direction, up to 5–7 mm from the lateral canthal tendon (figure 1B). A lateral tension test was then performed to establish the amount of lower lid shortening through a wedge resection of the lateral portion of the tarsus. The degree of shortening depended on the amount of the eyelid laxity.

Resection of the posterior lamella (ranging from 4 to 6 mm) was then performed to remove the vertical wedge (figure 1C). Subsequently, two needles of the suture were passed into the remaining tarsal lateral tissue to obtain a corrected alignment of the tarsus (figure 2A).

A horizontal incision of 8–10 mm was then made on the skin, extending from the lateral orbital rim in a posterior direction, 3–4 mm above the superior margin of the pupil. This incision was made to expose the periosteum of the frontal process of the zygoma. As the periosteum should be exposed with a limited dissection to minimise postoperative oedema, two small, sharp-pointed rakes were placed within the wound to stretch and expose the superior temporal rim.

Following this, the sutures were passed through the superficial lateral canthal ligament towards the lateral orbital rim periosteum. By pulling the superficial ligament diagonally, we directly obtained the suspension of the superficial ligament and indirectly the imbrication of the lateral canthal tendon. The needles of the Novolene suture were then advanced and delivered into the orbital rim incision, and both sutures were anchored to the periosteum (figure 2B). The tension of the sutures must be strong enough to pull the lower eyelid both upward and backward into contact with the eye globe. The degree of eyelid elevation and the lateral upsweep resulting from the procedure were totally dependent on the patient's needs and preferences. Both the sutures were anchored to the periosteum of the frontal process of the zygoma, at a level corresponding to the superior margin of the pupil, and the knot was tightened just enough to keep the lower eyelid in a slightly overcorrected position.[1]

Finally, the superior wound was closed in two layers with 5–0 absorbable sutures in the orbicular plane, to cover the ends of the 'belt suture', and 6–0 interrupted cutaneous sutures. The incision in the grey line was closed with a 6–0 interrupted Prolene suture. At the end of the procedure, special attention was given to avoid rubbing the sutures or knots on the conjunctival surface and cornea. The cutaneous sutures were removed on the 7th postoperative day. The surgical site was treated with an ice pack to minimise postoperative oedema and ophthalmic antibiotic ointment was applied twice daily to the surgical incision for 1 week.

Table 2 Description, type of ectropion and rate of success of patients operated with standard lateral tarsal strip technique

Type of ectropion	Monolateral		Bilateral		N (%)	Rate of success (%)
	Male	Female	Male	Female		
Involutional	2	6	8	14	30 (45.4)	90
Lid retraction	0	1	2	1	4 (6.06)	100
Paralytic	7	11	0	2	20 (30.3)	75
Cicatricial	3	7	1	1	12 (18.2)	58.3
Total	37		29		66	

Table 3 Ectropion Grading Scale proposed by Moe and Linder[3]

Ectropion Grading Scale	
0	Normal eyelid appearance and function
I	Normal appearance but symptomatic; eyelid laxity present on examination
II	Scleral show without eversion of lower eyelid
III	Ectropion without eversion of lacrimal punctum
IV	Advanced ectropion with eversion of lacrimal punctum from lacrimal lake
V	Ectropion with complication (eg, conjunctival metaplasia, retraction of anterior lamella or stenosis of lacrimal system)
L	Predominantly lateral
M	Predominantly medial
LM	Combined medial and lateral

RESULTS

Clinical outcome of the *tarsal belt* procedure

The procedure was time efficient, taking less than 30 min when performed by an experienced surgeon. No infections occurred,

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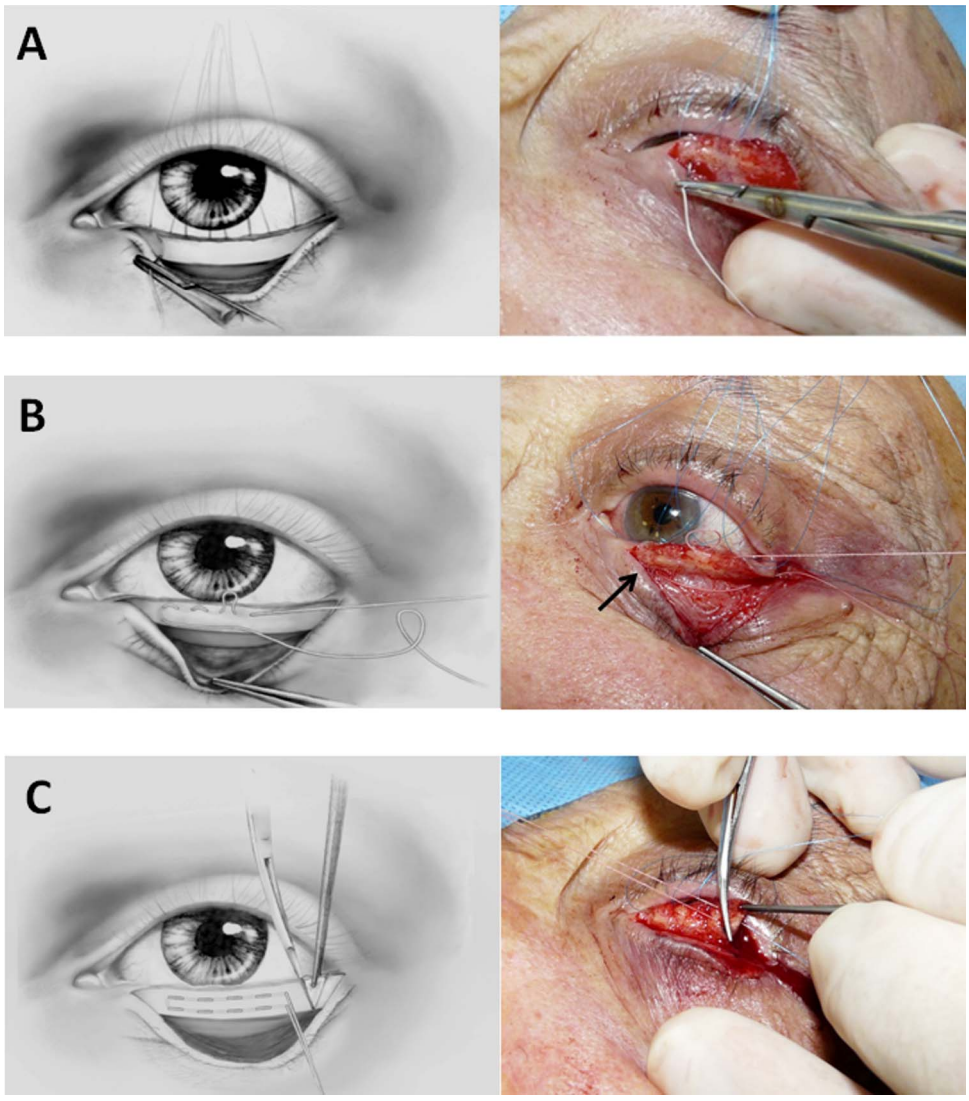

Figure 1 Schematic drawing and photographic illustrations of the *tarsal belt* procedure: (A) the first passage of the 6/0 Novolene suture is in the tarsus close to the lacrimal punctum in a vertical direction to define the distance between the superior and inferior passages of the double mattress sutures; (B) position of the 'belt suture' into the tarsus; the superior and inferior mattress passages are carried horizontally in the lateral direction until 5–6 mm from the lateral canthal tendon; (C) the vertical wedge excision of a lateral portion of the tarsus close to the lateral canthal tendon position. The resection of the posterior lamella ranged from 4 to 6 mm, with the degree of shortening depending on the amount of eyelid laxity.

nor was there unfavourable scarring or eyelid malfunction. All patients experienced minimal postoperative pain and mild postoperative oedema that disappeared within 1 week.

Rate of success was 100% for involutional and cicatricial ectropions, 90% for lid retraction and 87.5% for paralytic ectropions (table 1). No immediate surgical failures were reported (figures 3 and 4) and anatomical success according to EGS scale was obtained in 41 patients. Recurrence of ectropion occurred in one patient (paralityc ectropion) 6 months after the first surgery and required further intervention with a larger posterior lamella resection and new *tarsal belt* suture.

In the postoperative period, two patients (4.76%) presented specific complications. In one patient (lid retraction), 6/0 Novolene suture was removed 2 months after surgery due to an abscess formation around the suture, while in another patient (paralityc ectropion) an extrusion of non-absorbable suture occurred 3 months after surgery. Six months later, the procedure was successfully repeated in these patients without any further complication.

Moreover, one patient affected by LM grade IV involutional ectropion had a persistent epiphora due to lacrimal dysfunction following the lateral dislocation of the inferior punctum (EGS grade I on follow-up).

Despite these complications, surgical outcome at 24-month follow-up was still good with 41 patients rated to EGS grade 0 and one patient to grade I (table 3).

Clinical outcome of the LTS procedure

During the same period, 66 patients were operated with the LTS procedure (table 2). Rate of success was 100% for lid retraction cases. In cases of involutional ectropion, the rate of success was still high (90%), except for three cases of grade IV where an immediate recurrence of ectropion was observed. The rate of success for paralytic ectropion was 75%, with five cases of failure. These patients presented severe paralysis of the orbicularis oculi muscle associated with a prominent tarsal plate eversion. LTS procedure was successful and long-lasting in seven cases of cicatricial ectropion (58.3%) while in the remaining five cases a II/III grade ectropion persisted after surgery.

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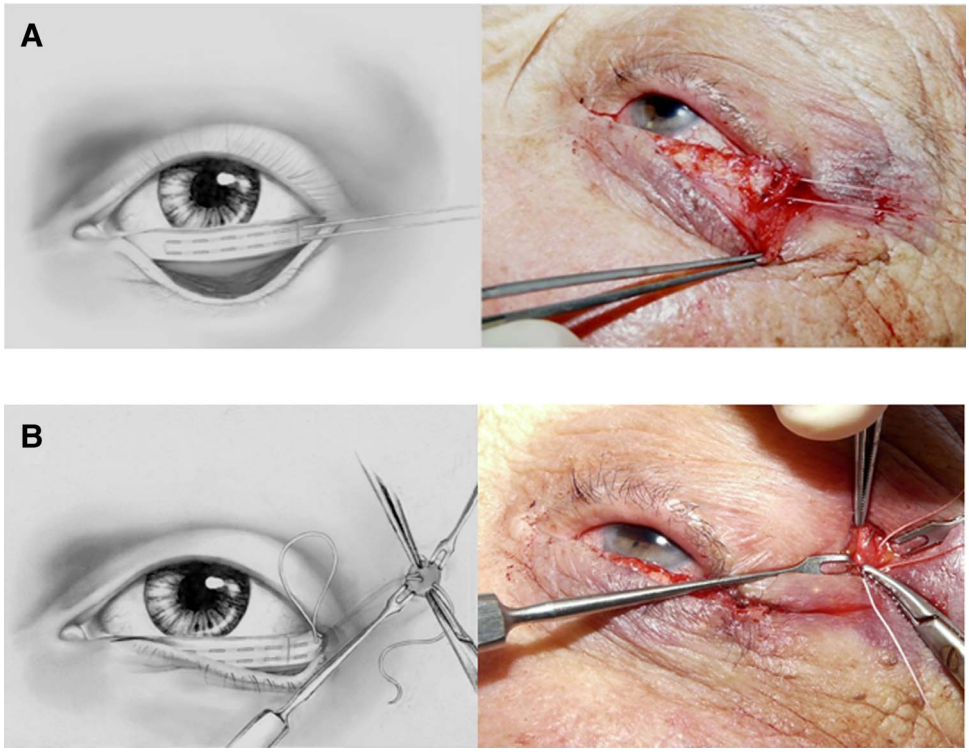

Figure 2 Schematic drawing and photographic illustrations of the *tarsal belt* procedure: (A) the corrected aligning of the tarsus after excision. The two needles of the suture are then passed in to the remaining tarsal lateral portions; (B) the sutures anchored to the periosteum of the frontal process of the zygoma.

DISCUSSION

Surgery is the best way to achieve a long-lasting correction of persistent ectropion, a defect that could compromise corneal integrity and cause permanent visual loss. Generally speaking, the ideal surgical technique for ectropion's correction should have as its main goals the lid tightening and horizontal shortening, the rotation of the tarsal plate in case of a high degree of eversion, and the lifting of the canthal lateral ligament.

Several surgical procedures have been developed under different names, including LTS,[6] lateral canthal ligament plication,[7–9]

Figure 3 Surgery outcome in a 62-year-old patient with grade IV L, monolateral paralytic ectropion. (A) preoperative frontal view; (B) 1-year postoperative frontal view; (C) preoperative lateral view; and (D) postoperative lateral view. The 'belt-like' mechanism of suture provides an upward directed vector and pushes the posterior edge of the lid margin against the eye globe.

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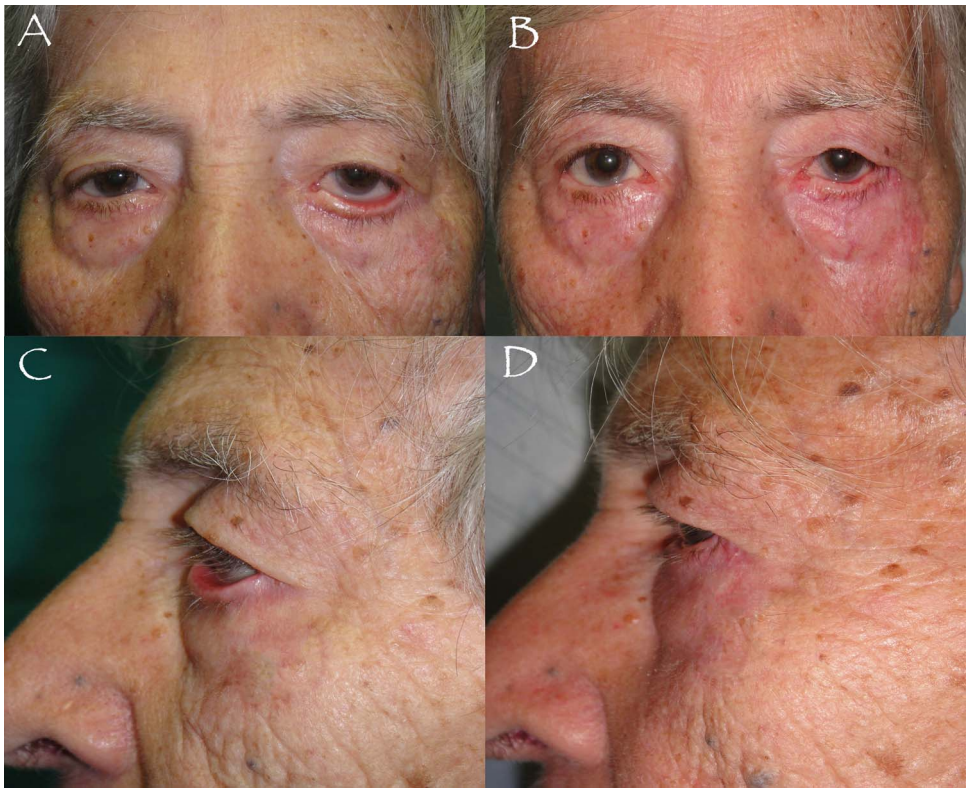

Figure 4 Surgery outcome in a 66-year-old patient with grade III, monolateral involutional ectropion, without eversion of lacrimal punctum. (A) Preoperative frontal view; (B) 1-year postoperative frontal view; (C) preoperative lateral view; and (D) postoperative lateral view.

lateral canthal ligament resection,[10] wedge tarsectomy,[11] Z-plasty,[1] skin graft,[12 13] local flaps,[14] cartilage graft,[15] fascial slings[16 17] and combined procedures.[1 18] However, despite these major efforts, many of these techniques still present problems associated with the surgical procedure and results.

Over the last two decades, the attention of this surgery has been moved from the lid to the lateral canthal region, and various techniques based on tightening of the tars ligamentous sling in a lateral direction have been developed: anterior canthopexy,[7 8 19] lateral transorbital canthopexy,[3] lateral retinacula suspension[20] and tarsal suspension canthoplasty.[10] More recently, Hayashi *et al*[21] published an interesting alternative technique for the correction of the paralytic ectropion using a lid anchor suture.

In the popular Kunth–Szymanowski lid resection technique,[11] the lid margin is shortened by the removal of a vertical wedge in the whole posterior lamella.[5] The main problems associated with this technique are the worsening of lateral canthal dehiscence with the creation of lateral canthal phimosis and central-lid notching. To enforce the lateral canthal tendon, in 1977 Tenzel *et al*[9] introduced the lateral sling canthoplasty for ectropion correction, focusing on tightening and elevating a slack lateral tendon. A major advance was made in 1979, when Anderson and Gordy[6] proposed the LTS procedure, which included a lateral canthotomy and cantholysis. In this technique, the skin and conjunctiva are excised, leaving a free strip of tarsus that must be anchored to the internal wall of the orbital rim, a few millimetres higher than its natural seat.[5] Nonetheless, despite its popularity, some authors have reported several problems. Moe and Linder reported a dysfunction of the lower eyelid caused by malposition rather than an excess of tissue and recurrence or exacerbation of the ectropion caused by the resection of one or more layers of the eyelid.[3] Other authors also experienced difficulty related to suture placement during the repositioning of the lateral canthal ligament.[22] Further complications may arise from the disruption of the lateral canthal angle that can lead to dehiscence, overlapping of the eyelids with failure of proper eyelid positioning, trichiasis, alteration of eyelid contour, obtrusive scarring, rounding of the canthus and loss of cilia.[23]

The success of the LTS technique is undoubtedly due to its simplicity and for this reason it is routinely used for ectropion correction at our Department. Nonetheless, based on our practice, we believe that the LTS rate of success may depend on EGS grade and/or aetiology of the ectropion. More specifically, the most challenging aspect was to establish the exact amount of tarsal strip to be removed, with the risk of not achieving a sufficient level of ectropion correction in case of an insufficient amount, or cause excessive stretching of the inferior eyelid in case of an excessive amount.

Our proposed technique called *tarsal belt*, adopts a double mechanism: the shortening of the eyelid, as in the LTS, in addition to its suspension and rotation resulting from the belt shape suture. Both mechanisms contribute to the ectropion correction and thus the amount of eyelid resection becomes less relevant to the achievement of surgical success. In addition, the particular design of the double mattress suture, the multiple intratarsal passages and the typology of a non-absorbable material produce a safe support and a stable suspension of the tarsal plate. Furthermore, the belt conformation of the suture, with its superior upper passage close to the ciliar margin, also produces a good rotation of the eversion tarsus and pulls the lower lid both upward and backward into contact with the eye globe.

As reported by other authors,[24] another possible complication associated with the LTS technique is that the canthoplasty relies

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on a relatively small area of scar to maintain the canthal position which is susceptible to dehiscence causing loosening of the lid. In addition, occasionally, the periosteal attachment may result as problematic because the thin periosteum on the inner portion of the orbital rim is easily shredded by the needle.[24] In such cases, a bone hole could be necessary on the orbital rim to anchor the tarsal strip while the *tarsal belt* is performed without canthotomy, leaving the lateral canthal tendon intact. In fact, the belt suture, by passing throughout the lateral ligament diagonally, suspends the superficial ligament and indirectly imbricates the lateral canthal tendon. Another advantage of this technique consists in anchoring the suture to the periosteum of the frontal process of the zygoma, which can be raised more easily compared with the orbital tuberculum used in the LTS. Moreover, the periosteum in this area is also thick and tight enough for stable placement of the belt suture.

Despite the achieved results, in case of cicatricial ectropions, where the lid malposition is caused by scar contracture and tissue deficiency in any of the three lamellae, the described technique may not be sufficient enough to restore normal anatomy. The surgical management of cicatricial ectropions depends on the situation after the release of the scar traction in the lower lid area. In these cases, the complete dissection of the inferior eyelid is required. Nonetheless, the *tarsal belt* technique can still be adopted in conjunction with different surgical techniques (such as skin, cartilage or/and conjunctiva grafts)[2 25] to restore the involved lamella.

Last, patients with longstanding advanced grade IV or V ectropion may also require adjustment of the medial canthus for full restoration of eyelid contour.

CONCLUSIONS

In the present study, we have presented an alternative surgical technique for ectropion correction, acknowledged as *tarsal belt*. Although this is the first report on a relatively small cohort of patients, the technique has proved to be effective to correct the horizontal and vertical instability of the lid. The sutures provide lower eyelid support for the entire tarsal plate and mild elevation of the canthal tendon length, correcting the outward buckling of the lower lid. The technique is simple and can be performed in combination with other lid surgeries. The results are long-lasting, with acceptable incidence of complications.

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Competing interests None.

Patient consent Obtained.

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