Posterior approach white-line advancement ptosis repair: the evolving posterior approach to ptosis surgery.

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Introduction

We describe a surgical technique for ptosis correction in moderate to good levator function involving advancement of the levator aponeurosis via a transconjunctival posterior approach without resection of Muller's muscle. We present our experience of and the results from this method and review the evolution of posterior approach ptosis surgery.

Purpose

To assess the efficacy and predictability of posterior approach white line advancement ptosis repair.

Methods

Retrospective analysis of all patients with primary aponeurotic ptosis undergoing posterior-approach repair using white-line advancement between December 2007 to June 2008. We describe a technique whereby after dissection of the Muller's-conjunctiva composite flap, the levator aponeurosis is advanced with double armed sutures through the white line, then through tarsus and out through skin.

Results

112 ptosis procedures in total during this period of which 71 eyelids of 41 patients were eligible for inclusion. There were 14 males and 27 females. The mean age was 63.76 years (range 24 to 87 years). Minimum follow up was 3 months (12 weeks-43 weeks). Of the 71 procedures, 42 were combined with a blepharoplasty. 62 achieved their desired lid height, contour and symmetry (87.3% success rate). No patients were overcorrected. Success rate in the phenylephrine positive group (42/71) was 88.1% compared to 100 % in phenylephrine negative group (4/71).

Conclusions

We present a modified approach to ptosis correction via a posterior approach. It has a high success rate and good cosmetic outcome. It is technically straightforward and easy to learn.

Keywords: aponeurotic ptosis, posterior approach

Introduction

Surgery for aponeurotic ptosis has conventionally been directed upon the levator aponeurosis complex, in the majority of cases, through an anterior approach[1]. The transconjunctival route was probably the first method of surgery employed to shorten the levator muscle. [2-6] Posterior approach surgery was further popularised utilising Muller's muscle and tarsoconjunctival resection[7,8]. Traditionally this posterior approach is reserved for those with minimal ptosis and a positive response to phenylephrine test[7,8,9]. In 1961 Fasanella and Servat[7] first described their technique initially describing a " resection of Muller's muscle, levator, tarsus and conjunctiva." Histological studies have since shown that the tissue resected consisted of a predominately tarsoconjunctival layer[10,11] and we now regard the Fasanella servat technique as a tarsoconjunctival resection. Muller's muscle conjunctival resection (MMCR) was first reported by Putterman in 1975[8], where he dissected Muller's blindly off its bed on the aponeurosis with the aid of a special clamp. This was found to be effective in mild phenylephrine positive ptosis cases. Further modifications to this technique include an open sky MMCR and a conjunctival sparing muller resection [12,13]. We describe a surgical technique involving advancement of the posterior surface of the levator aponeurosis (the white-line) via a transconjunctival posterior approach without resection of Muller's muscle. Abraham Werb [29], working in our unit in East Grinstead, in the1970's was the first to highlight the importance of advancing the white-line via a posterior approach. The white-line is best described as the distal levator aponeurosis viewed from posteriorly. Although similar techniques have been reported [13], to our knowledge, the outcomes of advancing

the posterior surface of the levator aponeurosis (white-line) through a transconjunctival approach, without resection of Muller's muscle has not been reported.

Materials and Methods

This was a retrospective case series, in which the notes of all patients undergoing surgery for primary involutional aponeurotic ptosis between December 2007 and June 2008 at the Queen Victoria Hospital, East Grinstead, UK, were reviewed. Institutional review board approval was obtained for this retrospective study.

Primary involutional aponeurotic ptosis had been diagnosed in patients with ptosis that was constant in all positions of gaze, moderate to good levator function (levator function > 8mm) and a high or absent skin crease. Patients with congenital, myogenic, neurogenic or traumatic aponeurotic ptosis, inadequate data, including post-operative follow up data with photographs less than 3 months, and those who underwent anterior approach or Muller's muscle excision were excluded.

A total of 41 patients undergoing 71 procedures for involutional aponeurotic posterior approach ptosis repair were identified.

Data collected included age, gender, type of ptosis (primary or recurrent), details of any previous ptosis surgery, preoperative upper eyelid margin-reflex distance (MRD), levator

function and skin crease height. Response to instillation of phenylephrine 2.5% was also documented preoperatively, with an elevation in lid height deemed a positive result.

Patients were examined postoperatively at 2 weeks and 3 months. Post operative measurements at the last follow up visit were used for comparison. Post operative complications and follow up time were documented. Surgical success was defined as a postoperative MRD of ≥2mm and ≤4.5mm, inter-eyelid height asymmetry of ≤1mm, and satisfactory eyelid contour.

Surgical technique:

All cases were performed under local anaesthesia with 1ml subcutaneous infiltration, both along the skin crease and in the mid-pupil pretarsal region and 0.5ml subconjunctival infiltration upon eyelid eversion using 2% lignocaine with 1:80000 adrenaline (Figure 1A). Most patients also received a bolus injection of intravenous sedation immediately prior to local anaesthetic infiltration, but were alert for the remainder of the procedure.

The desired skin crease was marked and a 4-0 silk traction suture placed in the grey line of the upper eyelid, which was then everted over a Desmarres retractor. Gentle diathermy was applied prior to a conjunctival incision made with a no 15 Bard parker blade along but above the superior border of the tarsus (Figure 1C). Muller's muscle and conjunctiva was dissected off as a composite flap until the white-line, which represents the posterior border of the levator aponeurosis, was identified (Figure 1D). A double armed 5-0 vicryl

suture was placed centrally through the posterior belly of the white-line (Figure 1E), in a forehand manner and was then passed through the conjunctival surface of the tarsal plate, 1mm below its superior border (Figure 1F), and then through to the skin (Figure 1G). The suture was captured through the skin in the region of the skin crease. The lid height and contour was assessed after tying this first suture in a bow (Figure 1 H,I) and care was taken to ensure there was no slippage of the suture. If the eyelid position was deemed to be satisfactory, the suture was relaxed and a second suture was placed within 2-3mm lateral to the first in the method described above. Both sutures were then tied. If the lid height was too low after the first suture, it was then relaxed and a second suture was passed higher through the white-line and again through the tarsal plate and skin. If the upper eyelid contour appeared peaked after the first suture, then this was relaxed and a second suture was placed more central to the location of the peak. Using this method of altering the position of the second suture enabled minor adjustments to eyelid height and contour without the undue delay of removing the first suture in the majority of cases. In such situations, the first suture was gently tied so as to act a “support” rather than a “cardinal” suture. In the post-operative period the absorbable sutures were not removed and were left to dissolve spontaneously. Both Muller’s and conjunctiva were left to heal spontaneously with no excision of these structures.

In those cases with significant dermatochalasis the procedure was combined with a blepharoplasty. This was carried out prior to eyelid eversion and white-line advancement (Figure 1B). The technique involved either a skin only or skin-muscle blepharoplasty.

The orbital septum and orbital fat were not violated and therefore the anterior surface of the aponeurosis was never exposed. The double armed 5-0 vicryl sutures came out within the wound but through the soft tissue overlying the anterior surface of the tarsal plate. By tying the sutures here they remained buried when skin closure was carried out, usually with continuous 6-0 vicryl rapide.

Results

Patients:

112 ptosis procedures in total during this period of which 71 eyelids of 41 patients were eligible for inclusion. There were 14 males and 27 females. The mean age was 63.76 years ± 14.9 (range 24 to 87 years).

All the procedures were performed for primary involutional ptosis. 41 procedures were excluded as they didn't fit the inclusion criteria. The majority of procedures (84.5%) were simulataneous bilateral ptosis repairs.

Additional upper eyelid/brow procedures performed:

Blepharoplasty was simultaneously performed in 59% (42/71) of ptosis procedures. Additional endoscopic (2/71) and pretricheal (4/71) brow lifts were carried out.

Preoperative findings:

Mean MRD was 1.32 ± 1.23

59% (42/71) of cases were phenylephrine positive, 6% (4/71) were phenylephrine negative and in 35% (25/71) it was not documented.

Outcomes:

All patients had a minumum of 3 months follow up with a median post operative follow up of 17 weeks and the mean follow up was 20.35 weeks ± 9.6 (12-43).

The overall success rate was 87.3% (62/71). The mean MRD improved to 3.50 ± 1.06

All failures (9/71 eyelids of 9 patients) were due to undercorrection, rather than unsatisfactory contour. The mean time to failure was 4 weeks ± 4.07 (1-14 weeks).

The success rate in the phenylephrine positive group was 88.1% versus 100% in the phenylephrine negative group.

Discussion

We describe a surgical technique for involutional ptosis involving advancement of the posterior surface of the levator aponeurosis via a transconjunctival posterior approach without resection of Muller's muscle or conjunctiva. Overall success rate was 87.3% and all patients achieved a satisfactory contour. Of those that needed further surgery (9/71, 12.7%), all were undercorrected with eyelid height asymmetry and no patients were

overcorrected. Our technique differs from previous reports of posterior approach ptosis surgery [12,14,15] as we do not dissect septum to expose the anterior surface of the levator nor is there any MMCR.

Advancement of a dehisced levator aponeurosis, as described in our technique, combines achievement of a predictable post-operative height expected with aponeurosis re-attachment and a predictable normal-looking eyelid contour seen with posterior-approach Muller's muscle resection surgery, yet avoids the need to excise any tissue, namely Muller's muscle or conjunctiva.

Although it would have been useful to compare the phenylephrine response positive with the response negative group the numbers were not sufficient to do so. However the principal of our technique is advancement of the posterior border of the aponeurosis rather than MMCR. One would therefore expect it to be effective irrespective of the response to phenylephrine.

Historically posterior approach ptosis surgery was first described by Blaskovic's[2,3] in 1923. He described a technique of extensive dissection of levator from its surrounding structures prior to its resection. Two sets of sutures were used, the first three were through the levator and the cut edge of the conjunctiva and the second three were "fold-forming" sutures through the levator only, and then both were passed anteriorly through the tarsus and skin. This was combined with a tarsectomy in all cases. Posterior approach surgery was further addressed by Agatston[4] who stated in 1942 that this technique was

becoming increasingly popular in the United States. In 1953 Berke[5], operating mainly on congenital cases, further simplified Blaskovic's technique. His technique still involved extensive dissection of levator from its surrounding structures however only one set of sutures was used and no tarsal excision was carried out. Following the early papers demonstrating the technique of anterior approach ptosis repair, posterior approach surgery was preferred when focussing on the posterior lamellar structures; tarsus, conjunctiva and Muller's muscle. MMCR is traditionally performed in patients who show eyelid elevation following instillation of topical phenylephrine. In 1961 Fasanella and Servat [7] described a procedure for patients with minimal blepharoptosis in which they applied two curved haemostats to the everted superior tarsus, ran a suture above them, and excised the tissues held by them. The Fasanella-Servat procedure is suitable for mild ptosis and involves a blind approach with predominately tarso-conjunctival resection. In 1975 Putterman and Urist [8] described their technique of MMCR. After separating the Muller's and conjunctiva from the surrounding structures a modified clamp was used and the tissue excised. They found that in most patients the upper eyelid was elevated to a normal level following instillation of 10% phenylephrine and an 8 mm MMCR produced a similar result. The authors recommended a 9mm resection if the phenylephrine test demonstrated a lower eyelid reponse, or a 7 mm resection if the response was higher than desired. At the same time, in Europe a technique for Muller's muscle resection was being popularized by Abraham Werb in our unit. This involved an incision at the superior border of the tarsal plate, dissection and excision of a conjunctival-Muller flap and advancement of the white-line to the tarsal plate and through to the skin crease. To our knowledge, Mr Werb [29] was the first to emphasise the importance of advancing the

white-line in this technique. His findings paved the way for others who had worked with Mr. Werb, namely Mr. Collin , to develop techniques in posterior approach levator advancement which are described later in the discussion.

Subsequent modifications to the MMCR technique describe a wide variety of algorithms to determine the appropriate amount of tissue resection to correct a given degree of ptosis [16,17]. Weinstein and Berger [16] suggest that a linear relation may exist between the resultant eyelid elevation and quantity of Muller's muscle resection. This technique begins with 8mm of resection to correct 2mm of ptosis, then adds or subtracts 1mm of resection to affect the final eyelid position by 0.25mm.

Dresner [17] describes a further modification of the MMCR technique whereby the amount of resection depends on the response to phenylephrine testing. When phenylephrine testing results in at least 2mm of eyelid elevation, Dresner applied the following algorithm: 4mm of resection for 1mm of ptosis, 6mm of resection for 1.5 mm of ptosis, 10mm of resection for 2mm of ptosis, and 11 or 12mm of resection for >3mm of ptosis.

It appears that widely disparate amounts of resection may yield acceptable surgical results for similar degrees of ptosis. Buchman et al [18] analysed histological specimens from 40 Fasanella-Servat cases which revealed 88% of cases had absent to minimal smooth muscle resection. However these patients had equally successful results in comparison to patients with moderate or large amounts of smooth muscle resection. Perry

et al [19] concluded that the success of this technique may result from either vertical posterior lamellar shortening, secondary contractile cicatrisation of the wound, or advancement of the Muller's muscle-levator aponeurosis complex on the tarsus. Perry et al [19] devised a new algorithm based on this theory whereby 9mm of Muller's resection should result in the same elevation that is produced by maximal stimulation with phenylephrine. If phenylephrine testing results in an undercorrection then tarsus was added to the resection.

More recently Lake et al [12] and Baldwin et al[14] reported their series of open sky MMCR in both phenylephrine test positive and negative groups. Their technique allowed direct visualization of Muller's muscle before its subtotal resection. Double-armed sutures were passed through the Muller's muscle stump, and the upper border of the tarsus through to the skin crease. They suggested that the success with the procedure lay, not from the degree of resection of Muller's muscle, but from the consequent advancement of the levator. As the sutures are passed through the stump of Muller's muscle (which originates at the distal edge of the inferior surface of the levator muscle) and then through the tarsus, one is in effect advancing the levator and attaching it to the tarsal plate and skin crease. This theory was further supported by the success of the procedure in phenylephrine negative patients. [14] More recently the authors have also reported a conjunctival sparing technique. [13]

Our technique is similar to that reported by Khooshabeh[12-14] in so far as it involves initial dissection of the composite flap of Muller's muscle and conjunctiva with direct

visualization of the tissues concerned. However once the posterior border of the levator aponeourosis is identified (the “white-line”), double armed sutures are passed through this white-line and then through the superior tarsus and skin. Only the aponeurosis is therefore advanced and neither Muller’s muscle or conjunctiva are excised. Although our current technique involves passing the suture through the epithelial surface of the superior border of the tarsal plate, since presenting this technique to colleagues it has been suggested that gentle diathermy of this area and scraping away of the epithelium with a 15-blade may provide better, more reliable long-term adhesion between the white-line and the tarsus by elimination of intervening epithelium. We have since included this step and have not encountered any adverse events since doing so.

We know from previous reports [20,21] that the levator aponeurosis particularly in asian eyelids comprises two layers, of which the anterior layer is thick with less smooth muscle fibres, and reflects superiorly a few millimeters above the tarsus to become contiguous with the orbital septum. The posterior layer is thin with more smooth muscle fibres, and becomes confluent with the lower one third of the tarsal plate and subcutaneous tissue. Occasionally, after placement of sutures in what appears to be a white line, there can be an undercorrection of ptosis. We have found that this usually arises from erroneous placement of sutures into the orbital septum (anterior layer of levator) that can occasionally appear as a white line. In such cases, the levator aponeurosis is often significantly thin and can be found by further dissection closer to the conjunctiva beyond a thin Muller’s muscle. As Muller’s muscle disappears, a thin white line can be identified. Following this, further dissection between this white line and the conjunctiva

can reveal a more healthy white sheet, that of the posterior surface of the levator aponeurosis. Placement of sutures into this white sheet, that is to say the healthier posterior surface of levator aponeurosis, will achieve the desired correction by a more effective advancement than simply plicating orbital septum to the tarsus.

The anatomical reasons for the success of Muller muscle conjunctival resection has been a matter of debate for some time now. Increasingly, it has been felt that the success of the procedure is due to advancement of the levator muscle itself, along with the aponeurosis. The mechanism by which Muller's muscle resection alleviates ptosis would therefore be by transmitting the contraction force of the levator muscle directly to the tarsal plate instead of through its aponeurotic attachment.

Levator advancement through a posterior approach has been previously reported. Collin et al [15] reported a technique in 1979 of reinserting the aponeurosis via a posterior approach. However their technique involved exposing the anterior surface of levator by dissection of the orbital septum and retraction of the preaponeurotic fat pad, effectively converting a posterior approach to the familiar anatomical view of an anterior approach ptosis repair. The initial posterior incision was recommended to be made 2 mm below the superior border of the tarsus in order to enter a tissue plane anterior to Muller's muscle. Consequently, although conjunctiva was largely preserved, the distal 2mm of Muller's muscle and 2mm of superior tarsus were excised. It is noteworthy that any degree tarsal

resection will further contribute to eyelid elevation regardless of muscle resection or levator advancement.

Ichinose et al [22] more recently used a similar technique to Collin et al without resecting Muller's muscle. The initial incision was 1mm below the superior border of the tarsus. Their technique also involved dissection of the orbital septum and exposure of the anterior surface of the levator. The aponeurosis was advanced down and sutured to the frontosuperior part of the tarsus. In addition Muller's muscle was reattached to the superior edge of the tarsal plate. Both of these techniques involved dissection of the levator anteriorly from its surrounding structures before its advancement.

Our technique differs in several ways. We do not dissect septum to expose the anterior surface of levator. We simply pass the sutures through the distal posterior border of the aponeurosis. Our initial incision is just above the superior border of the tarsus as opposed to below, avoiding any excision of tarsus. There is no excision of Muller's or conjunctiva and the Muller's-conjunctiva composite flap we create is simply replaced without the need for resuturing.

Although it has been suggested that advancement of the levator muscle may be the reason for the efficacy of the open sky MMCR [14], this is the first reported series whereby the principle goal is to identify and advance the lower border and posterior surface of the aponeurosis without any exposure of the anterior surface of the levator and without excision of any tissue. Conventional ptosis surgery in the presence of a functioning

levator muscle is now predominately on the aponeurosis of the levator complex via an anterior approach. There are some concerns regarding unpredictability of lid height but perhaps more so, contour with this procedure. This is particularly so for the medial undercorrection that occurs more commonly in anterior approach ptosis surgery. [23,24] Levator aponeurosis surgery was first advocated by Jones, Quickert and Wobig [1] for the treatment of involutional ptosis. They achieved a success rate of 89% in 57 patients in their original paper describing their technique.[1] In 1979 Anderson and Dixon [25] achieved a 83% success rate in acquired ptosis using the criteria of 1mm or less of residual ptosis as a success. In 1983, Older [26] reported a series of cases of aponeurotic repair for acquired ptosis and had a 95 % success rate within 1mm of the desired height in 113 patients with a minumum of 6 months follow up. However, Berlin and Vestal [27] reported for aponeurotic ptosis a 74% success rate within 1mm of desired height in 116 patients. A recent large representative study [28] of anterior levator advancement has shown that 77% of eyelids were symmetrical to within 1mm of the fellow eye after one operation, with 8.8% eyelids requiring further surgery to obtain this outcome. Bilateral cases were twice as likely to require reoperation.

Reports of Muller's muscle resection would suggest a higher success rate compared to that for anterior approach levator advancement. Putterman [9] published a study showing 90% of eyelids achieving within 1.5mm symmetry of the fellow eye. However these results were for predominately mild phenylephrine positive ptosis and if applied to our success criteria would result in a success rate of 75%. Dresner [17] reported 85% of eyelids being within 0.5 mm symmetry. Lake et al[12], describing their open sky technique in

phenylephrine positive patients, showed 98% were within 1mm symmetry with the fellow eye. In their second study [14] looking at phenylephrine negative patients all were within 0.5mm symmetry of the fellow eye.

Our Muller's muscle-conjunctival sparing technique results in a predictable degree of lid height and contour. In our series there was an 87% success rate and all patients had a good contour. Our criteria for success was somewhat more stringent than other reports in the literature where only an improvement in MRD is defined as success. The procedure can also be combined with a blepharoplasty and this was the case in the majority of our patients. We feel that a posterior approach is still justified in these cases because the septum has not been disturbed following a blepharoplasty. We feel it can be used in the majority of ptosis patients with moderate to good levator function.

This technique is easy to teach and learn. The anatomy is easily identifiable, there is minimal dissection and unlike the anterior approach there is little chance of losing your 'anatomical bearings'. We have demonstrated here its predictability and excellent success rate in involutional ptoses with moderate to good levator function.

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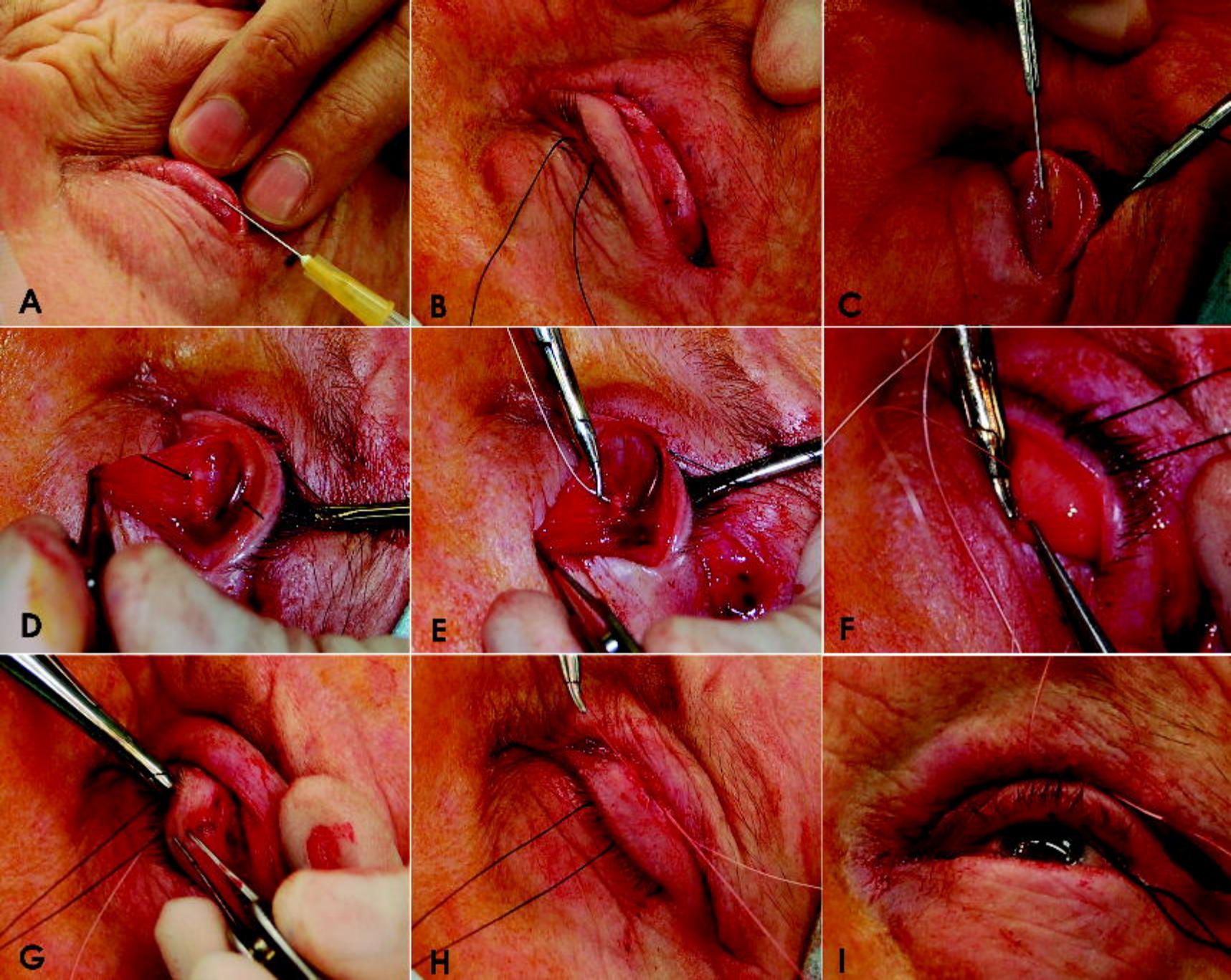
Figure Legend:

Figure 1 : Surgical Technique

A. local anaesthetic infiltration, B. blepharoplasty if indicated and grey line suture prior to everting the lid, C. Diathermy and conjunctival incision along but above the superior border of the tarsus, D. Muller's muscle and conjunctiva dissected off as a composite flap until the white-line is identified: long arrow highlighting white line, short arrow highlighting desmarres retractor showing, but not breaching, through a thin septum E. A double armed 5-0 vicryl suture is placed centrally through the white-line, F/G. suture passed through the conjunctival surface of the tarsal plate, 1mm below its superior border, and then through to the skin, H/I. Lid height and contour assessed after tying suture in a bow.

Figure 2:

Pre and postoperative photographs at 3 month follow up of three patients who underwent bilateral posterior approach white line advancement for aponeurotic ptosis.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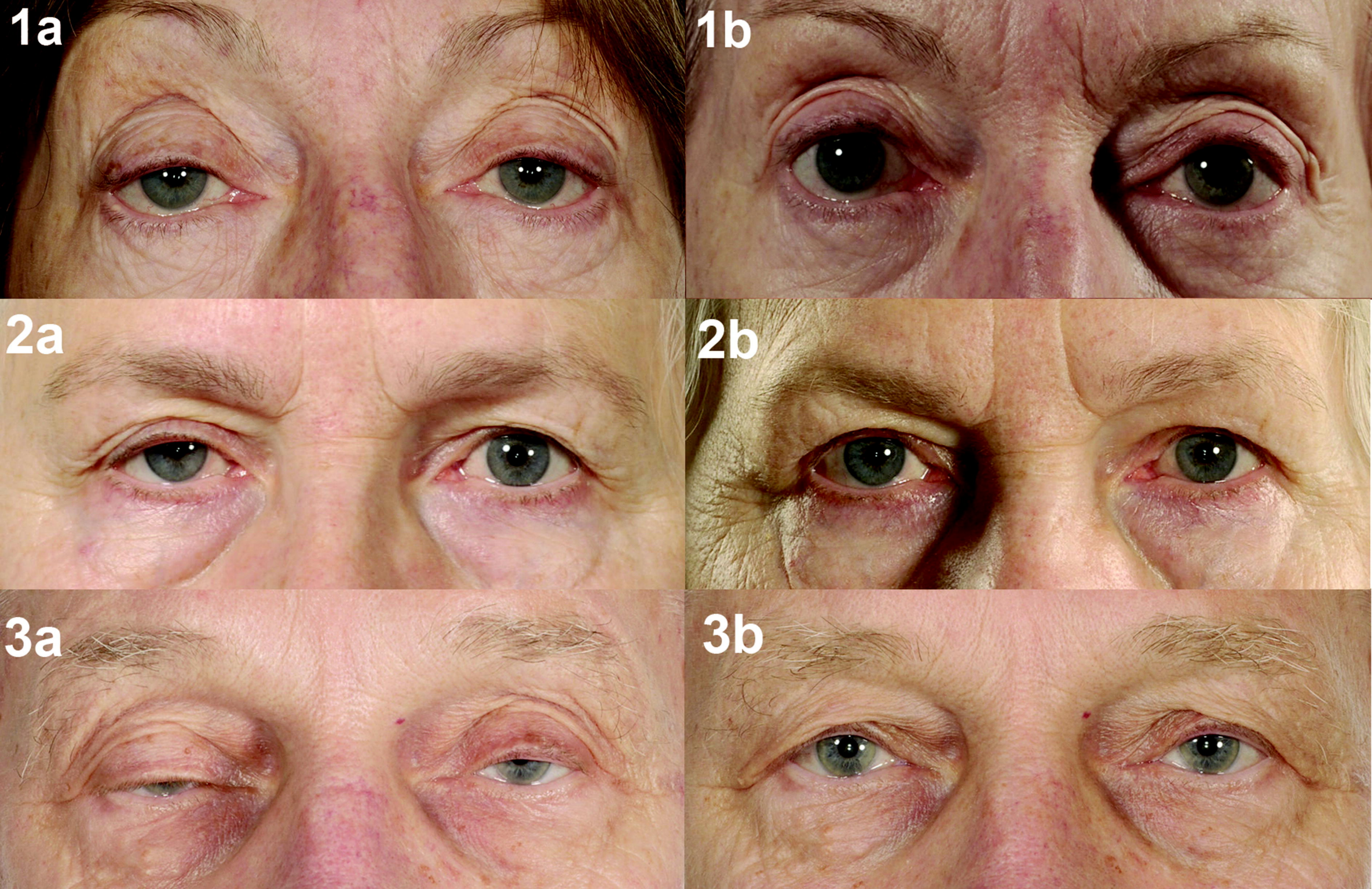
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