

Isolated Muller's muscle resection for the correction of blepharoptosis

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Abstract

Purpose To assess the outcome of isolated Muller's muscle resection with preservation of conjunctiva in patients with blepharoptosis and good to moderate levator function.

Methods This study was designed as a prospective, nonrandomised case series. Thirty-four eyes of 27 blepharoptosis patients were operated on, who were phenylephrine test-negative as well as positive. Open-sky Muller's muscle resection was performed with preservation of the conjunctiva. Main outcome measures were increase in margin reflex distance (MRD1), eyelid contour, and symptoms and signs of dry eye.

Results The mean increase in MRD1 was 2.75 mm. All but one patient (96%) had upper lid margins resting at or up to 1 mm below the limbus and obtained symmetry to within 0.5 mm of the fellow eye. No patients had symptoms or signs of dry eye.

Conclusion Isolated Muller's muscle resection is effective for the correction of ptosis in patients with moderate to good levator function. This is irrespective of the lid's response to phenylephrine. Preservation of conjunctival tissue eliminates concerns about dry eye, and also preserves the full height of the fornix.

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Keywords: blepharoptosis; Muller's muscle; conjunctiva; dry eye

Introduction

Muller's muscle was first described as a smooth muscle with many features of a striated muscle by Muller¹ in 1858. Isaksson² and Beard³ provided further detailed anatomical descriptions, highlighting the role of the small muscle in lid position.

Resection of Muller's muscle together with overlying conjunctiva for the correction of mild to moderate blepharoptosis was originally described by Putterman and Urist⁴ in 1975. This technique has been shown to be safe and effective in patients with good levator function and a positive response to the phenylephrine test. We have previously described an open-sky technique for Muller's muscle-conjunctival resection without the use of the clamp.⁵ This technique has several advantages over the closed technique originally described by Putterman.

Firstly, the technique is performed under direct visualisation of the relevant eyelid structures. Secondly, there is opportunity for intraoperative adjustment by placement of sutures higher up in the residual stump of Muller's muscle or by resection of a strip of tarsal plate, if necessary. In the event of adequate height, still not being achieved, the procedure may easily be converted to a posterior approach levator resection as described by Collin.⁶ The timing of removal of 'pull-out' silk sutures, also described by Collin in the same paper, allows some postoperative manipulation of lid height. Thirdly, the technique has been shown to be effective in phenylephrine test-negative as well as phenylephrine test-positive patients.⁷

In both Putterman's clamp technique and our open-sky modification, the overlying conjunctiva was excised in a single sheet with Muller's muscle. Dortzbach⁸ described a modification in which conjunctiva was preserved, but by his method intraoperative adjustment was not possible. This paper describes a modification of our open-sky technique that involves resection of Muller's muscle alone, thereby preserving healthy conjunctival tissue in its anatomical position. The authors of this paper propose that it is desirable to preserve healthy conjunctival tissue for two principal reasons. Firstly, there are no

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long-term studies looking at the effect of removal of conjunctiva. The preservation of tear film secretors is likely to be of benefit to patients as they get older. Secondly, resection of conjunctiva may lead to shallowing of the upper fornix. Preservation of the tissue in its anatomical position might extend the role of the technique in anophthalmic patients with ptosis, in whom fornix shallowing is a concern.

Methods

Patients were recruited in a primary and tertiary referral oculoplastics clinic. All patients had moderate to good levator function (>8 mm) and both phenylephrine test-positive and -negative patients were included. Patients requiring a simultaneous blepharoplasty were excluded. The phenylephrine test was performed after excluding a history of uncontrolled hypertension or untreated cardiovascular disease. One to two drops of 2.5% phenylephrine were instilled in the superior fornix. A positive test was recorded if there was an increase in upper lid height of 2 mm or greater after an interval of 4–5 min.

Informed consent was obtained according to regional hospital protocol. Thirty-four eyes of 27 patients were operated on by the senior author (RK) or the other author (HCB) under direct supervision.

Outcome was measured firstly in terms of lid height, and secondly on features of dry eye. The change in margin reflex distance of the upper lid (MRD1) and eyelid contour were recorded in each case. Successful outcome was defined as the upper lid margin being at or up to 1 mm below the superior limbus and symmetry to within 0.5 mm of the fellow eye. At each postoperative visit, presence or absence of dry eye symptoms (grittiness, burning) and signs (punctate epithelial erosions, tear film break-up time) were recorded.

Surgical technique

All operations were performed under local anaesthesia, apart from four children and one adult who required general anaesthetics (Caption 1).

The skin crease was marked at a matching height to the fellow eye or at 6–7 mm if bilateral ptosis was present. Half a millilitre of a 50:50 mixture of marcaine 0.5% and lignocaine 2% without adrenaline was injected above the lid margin. A traction suture was placed at the highest point of the lid margin, and the lid was everted over a Desmarres retractor. A further 0.5 ml of the same anaesthetic was injected under the conjunctiva superior to the tarsal plate. Conjunctiva and Muller's muscle were incised just above the upper border of the tarsal plate. The plane between Muller's muscle and the levator aponeurosis was identified and blunt dissection

on this plane was extended upwards until a rolled white band was seen (folded aponeurosis). Muller's muscle was then lifted off the conjunctiva up to the level of the fornix. At this stage, a subtotal Muller's muscle resection was performed, leaving a 2–3 mm stump. A double-ended 5/0 silk suture was placed through the conjunctiva at the level of the initial incision, through the stump of Muller's muscle, through the upper border of the tarsal plate, and finally out through the marked skin crease. This suture was tied on a loop and eyelid height and contour were checked. Two further sutures were placed through the same structures medially and laterally, and also tied on loops. Height and contour were checked before tying the sutures over cotton bolsters on the skin crease.

All eyelids were padded for 24 h, and the patients were asked to instill chloramphenicol drops four times daily and ointment at night for 2 weeks.

All patients were seen on the first day postoperatively, and at 5–7 days, 14 days, 1 month, and 3 months.

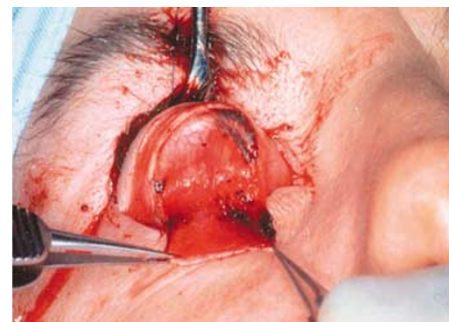
The silk 'pull-out' sutures were removed over the following 2 weeks as the ideal postoperative lid height was achieved.

CAPTION 1

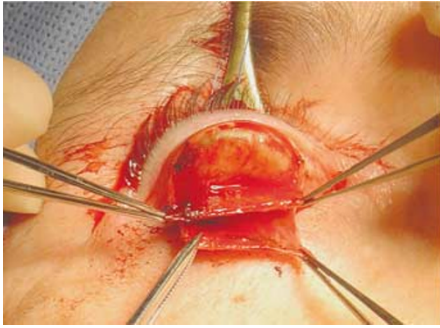
- (a) The lid is everted and conjunctiva and Muller's muscle incised just above the upper border of the tarsal plate.



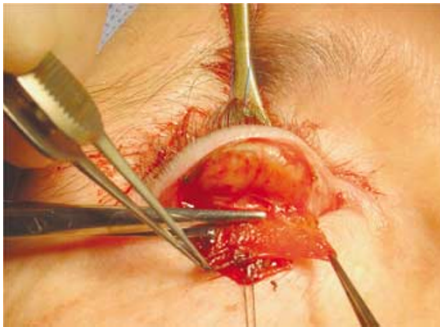
- (b) Blunt dissection is performed in the plane between Muller's muscle and the levator aponeurosis.



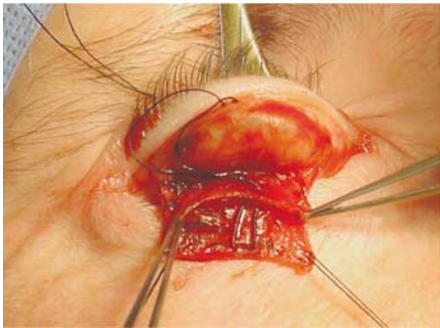
- (c) Muller's muscle is lifted off the conjunctiva up to the level of the fornix.



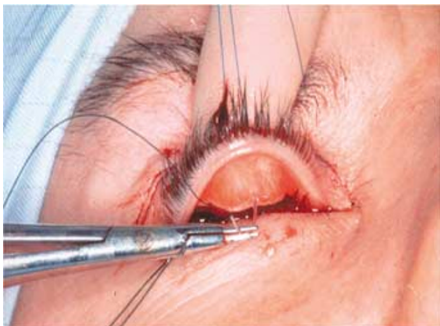
- (d) A subtotal Muller's muscle resection is performed, leaving a 2–3 mm stump.



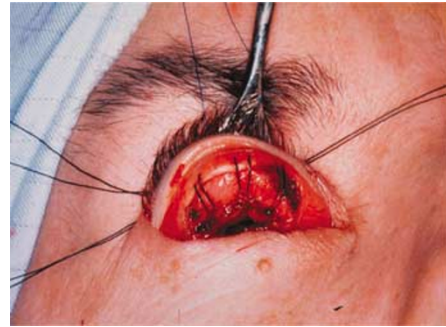
- (e) A double-ended 5/0 silk suture was placed through the conjunctiva at the level of the initial incision, through the stump of Muller's muscle.



- (f) Through the upper border of the tarsal plate and finally out through the marked skin crease.



- (g) This suture is tied on a loop and eyelid height and contour are checked before placing the other two sutures.



- (h) The eyelid at the end of the operation.



Results

Full data and 3 months' follow-up was available on 34 eyes of 27 patients. The mean age of the patients was 57 years (range 6–87 years). The aetiology was involutional in 15 patients, contact lens-related in six patients, congenital in four patients, one patient was anophthalmic, and one had blepharospasm. Thirty eyes showed a positive response to topical phenylephrine, whereas four did not.

The mean levator function was 11.47 mm (range 8–16 mm). The mean preoperative MRD1 was 0.86 mm (range –2 to 2.50 mm). The mean postoperative MRD1 was 3.47 mm (range 1.5–4 mm), giving a mean improvement in MRD1 of 2.75 mm (range 1–6 mm).

Twenty patients had unilateral ptosis (Figure 1). All but two had a final height at or 1 mm below the superior limbus. Of the two who did not obtain this result, one had severe contact dermatitis with eyelid swelling in the immediate postoperative period, which might have resulted in loosening of sutures. This patient was classified as a failure as her MRD1 improved by 1 mm only. The second patient was a child with an MRD1 of 2 mm in his 'good' eye. We aimed to undercorrect him for symmetry, and achieved a postoperative MRD1 of 2 mm

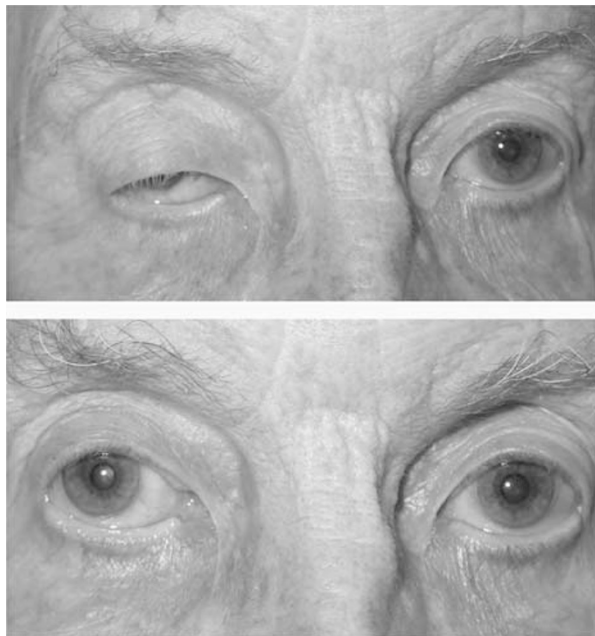


Figure 1 Unilateral ptosis corrected with isolated Muller's muscle resection.



Figure 2 Bilateral ptosis corrected with isolated Muller's muscle resection.

with good symmetry. He was therefore outside our success criteria, but had a good postoperative appearance.

Seven patients had bilateral surgery (Figure 2), five simultaneously and two sequentially. All had good lid height, contour, and symmetry postoperatively.

Contour was excellent in all but one case. One patient who had bilateral sequential surgery was thought to have a minimal medial flare in one eye.

No patient had symptoms or showed any signs of dry eyes at the 3 months follow-up visit, which was at least 10 weeks after cessation of postoperative topical antibiotics. One patient developed a small nodule of granulation tissue at the conjunctival incision. This was cauterised under local anaesthesia.

Discussion

Muller's muscle is a small smooth muscle arising from the striated levator muscle along with the aponeurosis at or slightly above the level of the superior fornix. Most anatomists agree that there is no tendon of origin. The body of Muller's muscle extends forwards and downwards for about 10 mm enclosed in a rich vascular sheath. It is firmly attached to conjunctiva, but easily separated from aponeurosis. Its nerve supply is from the cervical sympathetic chain.

Muller's muscle inserts onto the upper border of the tarsal plate through a 0.5–1.5 mm tendon. The attachment of the levator aponeurosis to the tarsal plate is less well

defined. It has been proposed that aponeurosis fibres insert onto the anterior surface of the tarsal plate, as well as into orbicularis fibres forming the skin crease.

Proponents of this theory support the aponeurosis as the main transmitter of levator contraction and therefore principally responsible for eyelid height.^{3,9} Based on this theory, traditional techniques for the correction of ptosis use aponeurosis advancement or resection to elevate the lid. By contrast, Berke and Wadsworth,¹⁰ Werb,¹¹ and Bang *et al*¹² propose that the levator aponeurosis ends blindly in a transverse ridge 2–3 mm above the tarsal plate. These authors believe that the aponeurosis supports the skin, the orbicularis, and the lashes, whereas the main upwards pull of the tarsal plate is relayed by Muller's muscle. A recent study has shown that Muller's muscle may be acting as a spindle in a stretch reflex.¹³ These latter papers place emphasis on the role of Muller's muscle in determining eyelid height. Collin's⁶ posterior approach describes resection or advancement of the levator aponeurosis through the conjunctiva, using only a small resection of Muller's muscle. He also describes a small tarsectomy. We propose that a larger resection of Muller's muscle removes the need for tarsectomy, or indeed resection of any of the levator aponeurosis. As Muller's muscle is resected and not eliminated, its action in autonomically mediated facial expressions is fortified rather than diminished.

A large representative study of anterior levator advancement¹⁴ has shown that 77% of eyelids were

symmetrical to within 1 mm of the fellow eye after one operation, with 8.8% eyelids requiring further surgery to obtain this outcome. A further 14% of eyelids were outside the desirable outcome, but the patients had declined further intervention. Bilateral cases were twice as likely to require reoperation. Reports of Muller's muscle resection indicate a higher success rate. Putterman published a study showing 90% of eyelids achieving within 1.5 mm symmetry of the fellow eye,⁴ and Dresner¹⁵ reported 84% of eyelids being within 0.5 mm symmetry to the fellow eye. In our original study describing the open-sky technique in phenylephrine test-positive patients, 92% of 61 eyes were within 0.5 mm symmetry and 98% lids were within 1 mm symmetry with the fellow eye.⁵

The open-sky technique with isolated Muller's muscle resection may therefore offer several advantages, firstly, over anterior aponeurosis advancement, and secondly, over Muller's muscle-conjunctival resection by the clamp technique. When compared with the anterior approach, there is similar opportunity for intraoperative adjustment of lid height, but the use of 'pull-out' silk sutures allows some postoperative control through the timing of their removal. A good contour is more consistently achieved than from the anterior approach as the force of the levator muscle is passed to the upper border of the tarsal plate, rather than lower down. When compared with the clamp technique for Muller's muscle-conjunctival resection, the first advantage is that there is direct visibility of eyelid anatomy. This omits the need for algorithms to calculate the amount of resection required. Furthermore, this approach can easily be converted to posterior approach levator resection, if adequate lid height is not achieved by Muller's muscle resection alone. This allows the technique to be safely attempted in phenylephrine test-negative patients, and also potentially in patients with poor levator function.⁷ In the open-sky technique, the sutures transmit the pull of Muller's muscle through orbicularis muscle and skin resulting in a predictable skin crease as well as a degree of lash eversion.

There have been several proposals to explain the mechanism whereby Muller's muscle-conjunctival resection is effective. We support Dresner's¹⁵ hypothesis that Muller's muscle resection effectively advances anterior extensions of the levator muscle, formed by Muller's muscle and the aponeurosis, and thereby fortifies the action of the levator.

The modification to our technique described in this paper allows preservation of healthy conjunctival tissue. Concern has previously been raised that excision of part of the tarsal conjunctiva, and therefore a proportion of goblet cells, might lead to dry eyes following this procedure. There were no subjective or objective

symptoms or signs of dry eye in our patients, supporting findings in previous publications.^{4,16,17} In fact, it appears that none of the elements necessary for a healthy tear film, including mucin secretors (goblet cells), lacrimal secretors (accessory lacrimal glands), and lipid secretors (meibomian glands) are significantly affected.¹⁸ However, there are no long-term follow-up data available in these patients, and it may be that their tear film could be compromised in later years. Patients with a history of dry eye are traditionally thought to be unsuitable for Muller's muscle-conjunctival resection, but may be able to benefit from the same procedure with preservation of conjunctiva. The preservation of the conjunctiva also has anatomical advantages. Although Putterman has reported safe use of his technique in 35 anophthalmic patients,¹⁹ preservation of conjunctiva would decrease the risk of fornix shallowing in these patients. Further studies with longer follow-up and objective measurements of conjunctival function and fornix height would provide more evidence for the value of this technique.

The role of surgery on Muller's muscle to correct congenital dystrophic ptosis is less clear. The four patients with congenital ptosis in this paper had good levator function and achieved excellent results (Figure 3).

We have described a small group of patients with moderate to good levator function, some of whom had no response to topical phenylephrine, who underwent a modified open-sky Muller's muscle resection. We conclude that subtotal resection of Muller's muscle alone with preservation of conjunctiva is a safe and effective procedure in this group of ptosis patients. The technique



Figure 3 Congenital ptosis (right eye) corrected with isolated Muller's muscle resection.

may confer advantages over previously described anterior and posterior approach ptosis surgery, and we believe it is worthy of consideration in the correction of ptosis.

None of the authors have financial interest in any material used in this procedure.

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