



Outcomes and complications of maximal levator resection for congenital Blepharoptosis with poor levator function

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General Note



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ABSTRACT

Objective: To evaluate the outcomes and complications of maximal levator resection as an alternative to frontalis suspension in cases of congenital blepharoptosis with poor levator function. **Methods:** This prospective study enrolled 39 patients with 50 eyelids, who had congenital ptosis (unilateral or bilateral) with less than or equal to 4 mm of levator excursion, and no history of ptosis surgical correction. Postoperative evaluation was conducted at 2 weeks, 6 months and 12 months; and included: margin reflex distance-1 (MRD1), lagophthalmos and complications. A post-operative MRD1 of 3 mm or more with a lid symmetry ≤ 1 mm was considered as successful outcome. **Results:** The mean age at the time of surgery was 3.8 ± 1.7 years (range, 2 to 9 years), with 12 months follow-up duration. Successful outcomes were achieved in 72% of eyelids (36 out of 50), and recurrence was recorded in 5 eyelids (10%). Factors such as preoperative levator function and MRD1 were not correlated with postoperative results. Complications included exposure keratopathy (16%), lid crease asymmetry (8%), entropion (4%), Lid notching (4%), eyelash ptosis (10%), and conjunctival prolapse (2%). The high rate of exposure-related corneal complications was correlated to the prominent lagophthalmos at the early postoperative weeks (3.9 ± 0.7 mm). **Conclusion:** Maximal levator resection is an effective treatment for congenital ptosis with poor levator function, which provides high rate of successful results and avoids complications of frontalis suspension. As the potential risk of exposure keratopathy is high, the ocular surface should be carefully screened during the early postoperative weeks.

Keywords: congenital blepharoptosis, maximal levator resection.

1. INTRODUCTION

Congenital ptosis is commonly caused by dystrophy of the levator palpebrae superioris (LPS) muscle (Wong et al., 2002). Patients with congenital ptosis are liable to develop amblyopia, especially if unilateral. Therefore, the treatment is crucial to avoid visual disturbance as well as cosmesis (Berry-Brincat and Willshaw, 2009).

Levator function is divided into three categories depending on lid excursion: good (>8 mm), fair (5–7 mm), and poor (0–4 mm) (Berke, 1958). It has been estimated that levator function is poor in 71.8% of congenital ptosis cases (El Essawy and El Sada, 2013). Levator function and degree of ptosis determine of surgical line of treatment (Cates and Tyers, 2001).

Several surgical procedures and modifications have been demonstrated to treat congenital ptosis with poor levator function. The two main surgical options are frontalis suspension and maximal levator resection (Lee and Kim, 2018). Although both methods have been reported to have satisfactory surgical success, the optimal treatment with lower complication rates is still debatable (Bernardini et al., 2013).

Frontalis suspension may be complicated by sling material extrusion or infection, and granuloma formation. Moreover, spontaneous compensatory frontalis overaction may be absent in unilateral or amblyopic eyes with poor fixation. In these challenging cases, unilateral frontalis slings are usually not satisfactory, and bilateral slings are not accepted by many parents (Bernardini et al., 2013) (Pacella et al., 2016).

We conducted this study to investigate the outcome and complications of treating congenital ptosis with poor levator function with maximal levator resection.

2. PATIENTS AND METHODS

This study is a prospective randomized interventional study, conducted at the Plastic and Reconstructive Surgery Unit, Research Institute of Ophthalmology, Egypt. Fifty eyes of 39 patients, who had congenital ptosis associated with poor levator function, underwent maximal levator resection surgery.

Inclusion criteria were congenital ptosis either unilateral or bilateral with less than or equal to 4 mm of levator excursion, and no previous surgical ptosis correction. Patients With other types of ptosis, previous surgical intervention, or inadequate data including inconsistent postoperative follow-up were excluded.

Postoperative examination was conducted at 2 weeks, 6 months and 12 months. The following criteria were evaluated: Margin reflex distance-1 (MRD1) (the distance between the centre of the pupil light reflex and the upper lid margin with the eye in the primary gaze); lid contour for asymmetry; lagophthalmos with eyes gently closed; and any complications. Success was defined as a post-operative MRD1 of 3 mm or more with a lid symmetry ≤ 1 mm.

Statistical Analysis

The data were presented as mean, standard deviations and ranges. Statistical analysis was performed using SPSS software V.23 (SPSS, Chicago, Illinois, USA). The paired t-test was employed to compare and analyse data and measurements. The results were considered statistically significant (S) with a P-value <0.05.

Surgical technique

After induction of general anaesthesia, the lid crease was marked and local anaesthetic with 1:100000 adrenaline injected subcutaneously. A 4/0 silk traction suture was inserted into the upper lid & a lubricated spatula was used to protect the eye.

A lid crease incision was made, followed by dissection of orbicularis muscle to reach the sub-orbicularis plane and release the levator aponeurosis attachments from the anterior surface of the tarsus and the underlying Muller's muscle. Both medial and lateral horns of the levator were carefully severed using Westcott scissors with preservation of Whitnall's ligament. The orbital septum was opened and the fat retracted; the muscle attachments were dissected until the superior orbital margin.

Three double-armed 6/0 vicryl sutures were placed in a horizontal mattress fashion through a partial thickness tarsus approximately 4 mm below the superior tarsal border, with the positioning of the upper lid margin was at the superior limbus. After evaluation of the lid position and contour, the sutures were tied down and the redundant levator tissue was clamped and excised.

The lid crease was reformed and the skin wounds were re approximated using 6/0 Prolene sutures. Topical antibiotic ointment on the wound site was prescribed every 8 hours for one week. In addition, artificial tears were prescribed every 2 hours, and the number of administrations was slowly tapered to twice daily.

Ethical Approval

The study was conducted in accordance with the tenets of Declaration of Helsinki and was approved by the local Ethics Committee of the Institute. Informed written consent was obtained from parents/guardians of all patients prior to their enrolment in this study.

3. RESULTS

A total of 50 eyelids from 39 patients with poor levator function underwent maximal levator resection. Twenty-eight (71.8%) underwent maximal levator resection for treatment of unilateral congenital ptosis, whereas 11 (28.2%) patients underwent bilateral surgery. Demographic characteristics of the patients are summarized in table 1.

Table 1 Demographic data of patients involved in the study

	n=39
Age (Years)	
Range	2 – 9
Mean±SD	3.8 ± 1.7
Sex	
Male	22 (56.4%)
Female	17 (43.6%)
Laterality	
Unilateral	28 (71.8%)
Bilateral	11 (28.2%)
Others	
Positive family history	3 (7.7%)



Figure 1 A representative case of successful surgical outcome. Pre-operative right severe ptosis (left), 12 months after surgery (right).

The mean age at the time of surgery was 3.8 ± 1.7 years (range, 24 months to 9 years). The follow-up duration was 12 months for all patients. The preoperative levator function was 2.8 ± 0.7 mm. Successful outcomes were achieved in 36 eyelids (72%) (Figure 1). Recurrence was reported in 5 eyes (10%); other post-operative complications were recorded in 11 eyes (22%).

Table 2 Comparison between pre-operative and other times as regarding MRD1

	n=50	P Value
Pre-operative		
Range	-1 – 2	
Mean±SD	0.4 ± 0.8	-
2 Weeks		
Range	3 – 5	
Mean±SD	4.1 ± 0.4	< 0.001*
6 Months		
Range	2 – 4	
Mean±SD	3.5 ± 0.7	< 0.001*
12 Months		
Range	1 – 4	
Mean±SD	3.1 ± 0.6	< 0.001*

*: Significant value at $P < 0.05$

As shown in table 2, the preoperative MRD1 was 0.4 ± 0.8 mm (range, -1 to +2 mm). In comparison to pre-operative mean values, MRD1 was significantly higher ($P < 0.001$) in all follow up visits. Two weeks after surgery, the mean of MRD1 was $4.1 (\pm 0.4)$ mm. Six months after surgery; the mean of MRD1 was $3.5 (\pm 0.7)$ mm. At the end of the follow up period, the mean of MRD1 was $3.1 (\pm 0.6)$ mm (Figure 2).

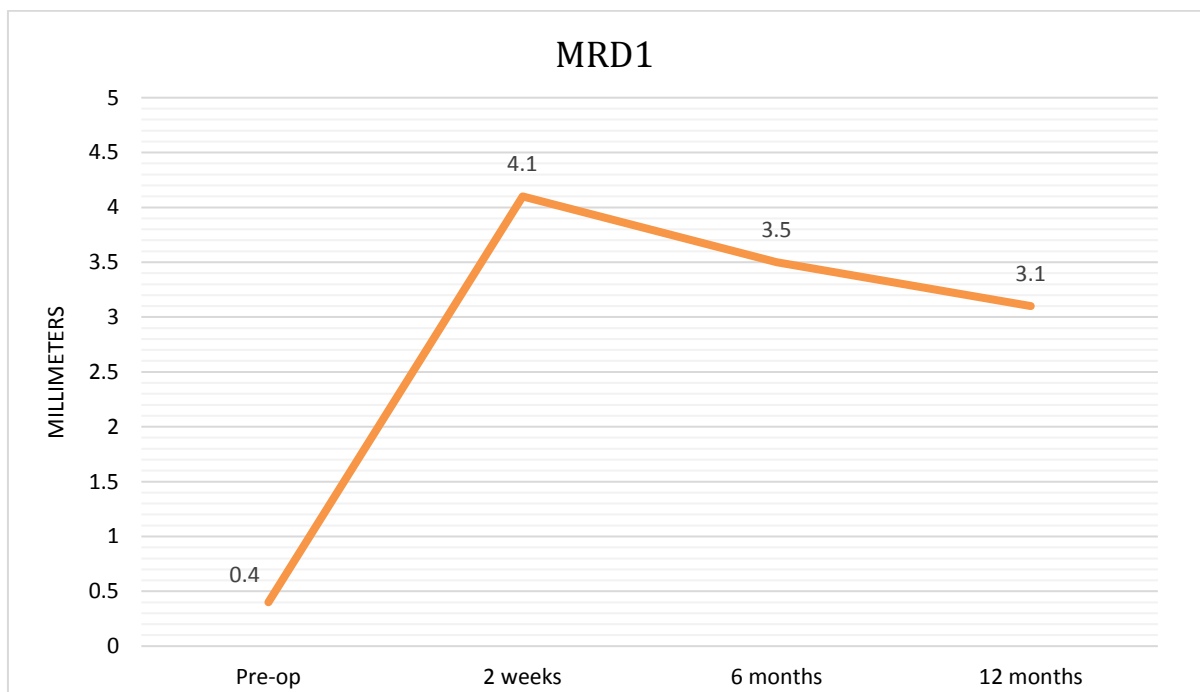


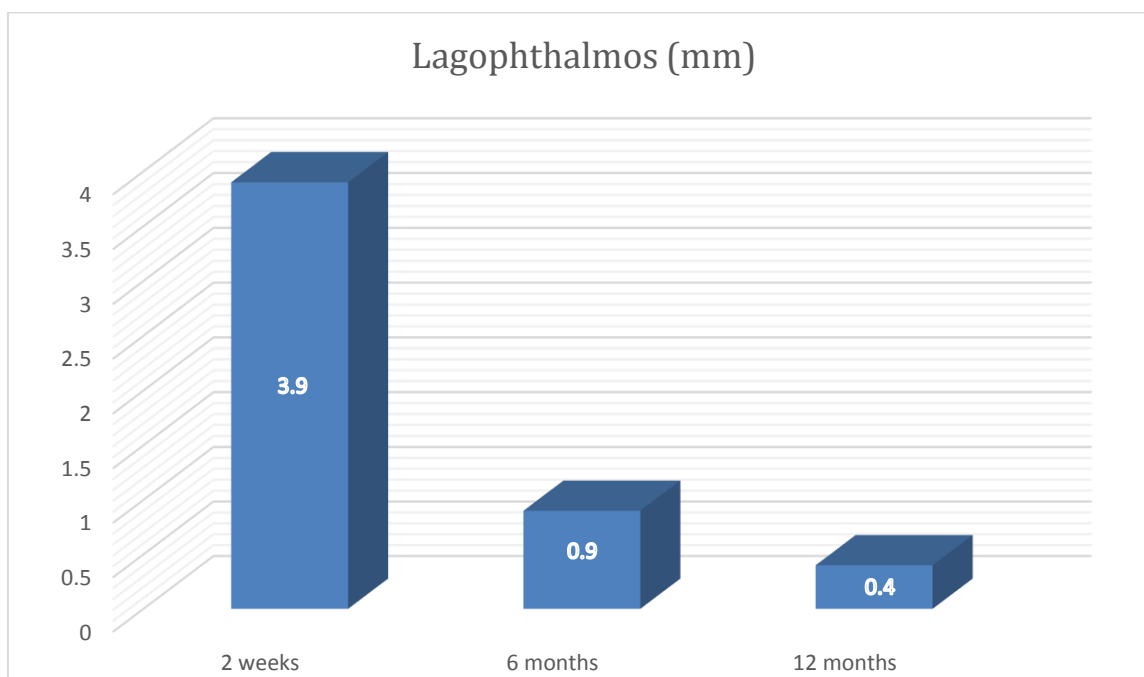
Figure 2 Progression of MRD1

A summary of the postoperative complications is illustrated in table 3. The highest rate among reported complications was of exposure keratopathy (16%).

Table 3 Postoperative complications

	n=50
Recurrence	5 (10%)
Lid notching	2 (4%)
Lid Crease Asymmetry	4 (8%)
Lash ptosis	5 (10%)
Entropion	2 (4%)
Exposure Keratopathy	
Superficial Punctate Keratitis (lower third)	7 (14%)
Corneal Epithelial Defect	1 (2%)
Conjunctival Prolapse	1 (2%)

Lagophthalmos was inevitable. The mean of lagophthalmos was 3.9 (± 0.7) mm, 0.9 (± 0.8) mm, 0.4 (± 0.5) mm; at 2 weeks, 6 months and 12 months after surgery, respectively (Figure 3). These results correlated with the potential risk of exposure keratopathy, as all exposure-related corneal complications were reported at the first two follow-up months.

**Figure 3** Lagophthalmos changes throughout the follow-up duration

All five patients of recurrence underwent reoperation by frontalis suspension using e-polytetrafluoroethylene as a sling material. Entropion repair was carried out in two cases, via an open approach anterior lamellar repositioning to rotate the lid margin; and excision of prolapsed conjunctiva in one patient. On the other hand, all cases of lash ptosis showed gradual spontaneous improvement -partial or complete- throughout follow up period.

Cases of Superficial Punctate Keratitis (SPK) responded completely to frequent lubrication and additional Fluorometholone drops. However, Corneal Epithelial Defect (CED) required a bandage contact lens, which was kept for 5 days, under topical antibiotic cover, to ensure full healing.

Factors that may have affected surgical outcome were analyzed in table 4. There were no significant differences between eyelids with successful results and those with unsuccessful results with respect to demographic data (age and sex), or preoperative measurements including MRD1 and levator function; as results were ($p=0.23$, $p=0.39$, $p=0.67$ and $p=0.36$, respectively).

Table 4 Comparison of factors between successful and unsuccessful groups

	Successful Outcome N=36	Unsuccessful Outcome N=14	P value
Age (Mean±SD)	3.9 ± 2.4	3.5 ± 1.9	0.226
Sex			
Male	20 (55.6%)	9 (64.3%)	0.398
Female	16 (44.4%)	5 (35.7%)	
Preop. MRD1	0.7 ± 1.0	0.8 ± 1.2	0.670
Preop. LF	2.9 ± 0.6	2.6 ± 0.5	0.367

LF: Levator Function

4. DISCUSSION

For management of congenital ptosis, levator function is the most important parameter to be considered in decision making. There are two main procedures for the surgical correction of congenital ptosis with poor levator function: frontalis suspension and maximal levator resection. Nevertheless, frontalis suspension is regarded by many surgeons to be the treatment of choice; they advocate levator surgery in case the levator function is more than 4 mm, and reserve frontalis suspension for patients with poor levator function (Harvey et al., 2010).

In previous studies where frontalis suspension was used, satisfactory outcomes varied from 73.0 to 95.0%. On the other hand, drawbacks included brow scars, donor-site morbidity and age limitation in case of autologous fascia lata, as well as complications related to allogeneic suspensory materials such as infection, exposure, and granuloma formation (Takahashi et al., 2010). Moreover, unilateral frontalis suspension may show less satisfactory outcomes, in the form of asymmetrical blinking and lag in downward gaze, or under-correction as a result of ipsilateral eye amblyopia and absence of spontaneous forehead elevation (Lee and Kim, 2018). Also, for a successful outcome, frontalis sling operation might be less beneficial than maximal resection, as improvement in postoperative levator function was demonstrated following levator resection, even in cases with poor levator function (Goncu et al., 2015).

For Whitnall's sling, the tarsus is just fixed to Whitnall's ligament, whereas in maximal resection sutures are taken as much as possible above the ligament to adjust the eyelid level. Whitnall's ligament has been observed to be dehiscent or atrophic in patients with severe ptosis, thus, it might not provide a sufficient strong support (Anderson et al., 1990). Maximal levator resection was first introduced in 1984. In that study, a good outcome was achieved in 50% of the cases, as well as better cosmetic results compared to bilateral frontalis suspension (Epstein and Putterman, 1984).

Mauriello et al., 1986, and Press and Hübner 2001, reported more than 80% acceptable or satisfactory outcomes with maximal levator resection in correcting congenital ptosis associated with low levator function. Recently, Cruz and associates 2014, Mete et al., 2017, and Lee et al., 2017 have published about the use of maximal levator resection in congenital ptosis in case of poor levator function. Significant increase ($P < 0.05$) in post-operative MRD1 values was observed in all studies, and successful results were obtained in 91.4%, 69.6% and 93.0%, respectively.

In the current study, preoperative levator function of both successful and unsuccessful outcome groups was analysed, among other factors, to determine whether or not it influenced the surgical results. There was no statically significant difference between the two groups. This is consistent with similar reports by Goncu et al., 2015 and Lee et al., 2017 that a significant difference was not noted in preoperative levator function between successful and unsuccessful operative outcomes. These results support that maximal levator resection can be effective even in patients with very low levator function.

As for surgical complications, all patients had lagophthalmos and lid lag on down gaze, which were fully explained prior to surgery. When a large portion of LPS is resected, the elastic characteristics of the eye lid are markedly impaired and downwardsaccadic movements are restricted, which provokes eyelid lag and lagophthalmos. Degree of lagophthalmos or lag was observed to decline with the passing of time (Cruz et al., 2014).

Our collected data show that this motility restrictive effect of the surgery varies considerably; it is most prominent in the early postoperative period, and in some cases, it lasted until the end of the follow-up (12 months after surgery). Therefore, the authors recommend short-interval careful ocular surface monitoring during the first follow-up weeks, alongside with intense lubrication. In addition, a bandage contact lens or intermittent use of the Frost suture can be applied in severe cases.

Other postoperative complications included entropion (2 patients, 4%), lash ptosis (5 patients, 10%), lid crease asymmetry (4 patients, 8%), and lid notching (2 patients, 4%). Reported complications of previous studies varied between exposure keratopathy

(11.1%), entropion (5.4-8.2%), eye lash ptosis (3.7-11.9%), and over correction (2.3%) (Press and Hübner 2001) (Cruz et al., 2014, Mete et al., 2017, Lee et al., 2017). Entropion or eyelash inversion are secondary to imbalance between the vertically shortened posterior lamella and the overhanging loose anterior lamella of the eyelid. Therefore, these complications could be minimized or prevented by elliptical excision of skin and orbicularis above the crease, followed by three interrupted lash-rotating (skin - tarsalplate - skin) sutures (Lee et al., 2017).

The high traction force exerted on the tarsus is the reason why the contributors of this article did not advocate tarsectomy to augment the effect of large resection of LPS. The decreased tarsal plate height could increase the risk of lid margin positional instability and entropion. Moreover, partial excision of the normal tarsus makes surgery more difficult if reoperation is required (Pak et al., 2006).

Study Limitations

We believe there are two limitations to this study. First, taking into consideration the young age of the study population, longer follow-up periods are needed to further assess the stability of outcomes. Second, although we met encouraging results, the surgical effectiveness of maximal levator resection should be validated in controlled studies.

5. CONCLUSION

Our results support that; maximal levator resection provides an effective treatment because of high successful outcomes with avoidance of the complications of frontalis suspension. As the potential risk of exposure keratopathy is high, the external eye surface should be carefully screened preoperatively to exclude contraindications such as dry eye syndrome and absent Bell's sign, as well as in the early weeks of postoperative follow-up.

Conflict of Interest

The authors declare no conflict of interest.

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