Original Article

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Evaluation of Mehta's modification of the Crawford technique for Frontalis Sling Surgery with Silicon rod in Severe Ptosis

Baydaa A. AL Abdullah [1], Mohammed Breesam Hatif [2]

[1] M.B.Ch.B, F. I. B. M. S. Ibn Sina Training Hospital

[2] M.B.CH.B, F. I. B. M. S. Al wasity Teaching Hospital.

ABSTRACT

Background: Ptosis is the drooping of the upper lid margin below its normal anatomic position due to the levator complex dysfunction. In this condition, the aesthetic and functional abnormality is obvious and is accompanied by severe visual field defect. Ptosis surgery is one of the most common oculoplastic procedures with different surgical procedures. The decision for an appropriate surgical procedure and the material used to minimize the incidence of complication depends on proper evaluation of the patient.

Aims of study: To evaluate Mehta's Modification of the Crawford technique for frontalis sling surgery with silicon rod in sever ptosis.

Patients and Methods: We considered 10 patients (12 lids) who were treated between February 2017 and June 2018. There were seven males and three females; two patients were bilateral and three patients had negative Bell's phenomenon, which was surgically treated with Mehta's modification of the Crawford technique for frontalis sling surgery with silicon rod. The patients' age ranged from 4 to 30 years; they all had severe eyelid ptosis (>4mm) with poor levator function (≤4 mm).

Results: Our patients' postoperative results were good, functional, and aesthetic, showing a clear visual field, with smooth and regular eyelid margin and no notching. Nine out of 10 patients achieved good results according to the above-mentioned criteria, and in addition to that, both patient and parents' satisfaction were taken into consideration. Only one patient had developed recurrence (1- month postop.)

Conclusions: Mehta's modification of the Crawford technique for frontalis sling surgery with silicon rod in sever ptosis used for the treatment of severe ptosis with poor levator excursion is an easy and simple procedure that promises good postoperative results.

Corresponding author: *Baydaa A. AL Abdullah, M.B.Ch.B,*

. E mail: baydaa.alabdulla@gmail.com

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INTRODUCTION

Ptosis, by definition, is the drooping of the upper eyelid below its normal position. There are many causes for ptosis: congenital, posttraumatic, myogenic, involutional, or neoplastic. All these lead to levator complex dysfunction, which affects the final upper eyelid position. The surgeon who deals with the treatment of ptosis should be familiar with the anatomy of lid, degree and type of ptosis, and the various types of surgical procedures used for ptosis correction. [1,2,3]

In most cases of congenital ptosis, the cause is idiopathic and may be secondary to local developmental defect in muscle structure. Acquired ptosis could aponeurotic, myogenic, neurogenic, traumatic, or mechanical. [4,5]

Patients with poor levator function are often treated with frontalis suspension. Suspension materials could be either autogenous such as fascia Lata, palmaris longus tendon or temporal fascia or synthetic materials such as silicon, nylon, silk, or Mersilene. [6,7,8]

There are various suspension designs that could be single pentagon (Fox procedure), double pentagon (Crawford procedure), single rhomboid (Firedenwald-glutton procedure), and double rhomboid (Hiff procedure). [9]

In this study, Mehta's modification of the Crawford technique for frontalis sling surgery with silicon rod had been used for patients with severe ptosis and poor levator function.

PATIENTS AND METHODS

Between February 2017 and June 2018, 10 patients (12 lids)—three females and seven males; two bilateral and three with negative Bell's phenomenon— were surgically treated using Mehta's modification of the Crawford technique for frontalis sling surgery with silicon rod. The patient data are shown in (Table 1). Those who had previously failed ptosis correction were excluded.

All the patients were subjected to a complete ophthalmological examination, including visual acuity, funduscopy, and slit-lamp examination by the ophthalmologist.

Preoperative evaluation included measurement of ptosis degree, Levator excursion, the frontalis muscle excursion, and Bell's phenomenon.

Operative method

All patients were operated in the supine position under general anesthesia with endotracheal intubation. After sterilization and draping, chloramphenicol 1% antibiotic ointment was applied in the eye, and using methylene blue ink, we started our marking.

First, we marked the center point of the eyelid, and then, we marked two points both lateral and medial to the center mark with one mm. distance; these two points were three mm distant from the eyelid margins. After those two points were marked, two more were marked – one near the medial canthus of the eyelid, and the other near the lateral canthus of the eyelid, thus ending with four markings on the upper eyelid.

Then, eyebrow marking was done by putting two marks 'one was slightly medial to the medial eyelid marking, and the other was slightly lateral to the lateral eyelid marking. These markings were joined to each other to complete two triangles on the medial and lateral side (Fig. 1).

After, the marking was infiltrated with 2% Xylocaine with 1: 100,000 adrenaline, then using no. 15 scalpel, we made a 3–4 mm long incision on previously marked eyebrow incisions i.e., both lateral and medial eyebrow, down to the level of the periosteum, where we

then made a pocket about 5×5 mm within the frontalis muscle for burying the rubber tube (sleeve) and the remaining ends of the silicon rod. After, using the no. 15 scalpel, four lid skin incisions of about 1.5 mm was done on previously marked upper eyelid incisions.

The silicon rod needle was then held firmly by the needle holder and passed from one brow incision (usually, we started at medial triangle) to the medial eyelid incision. The needle was then passed laterally, crossing through the tarsal plate, to exit and then was passed again through the tarsal plate to the other eyelid incision, which marked one mm. medial to the center point of the eyelid. The passage of the needle across the tarsal plate was facilitated by the tightening and stretching of the eyelid downward using two silk sutures at the upper eyelid margin.

Then, the needle passed backwards to the medial eyebrow incision, also posterior to the orbicularis muscle and orbital septum, so that the complete triangle was on the medial side of the eye after silicon rod was cut. The same procedure was repeated on the lateral side of the eye, so both the complete triangles were on both lateral and medial sides as shown in (Fig. 2).

After the needle was cut, we used a rubber tube (sleeve) (Fig. 2g), through which the two ends of the silicon rod were passed on both sides.

The silicon rod was adjusted and tightened gradually to obtain the optimum lid height and contour. A 6-0 polypropylene suture was passed within and around the sleeve to avoid the postoperative slippage of Silicon rode and the excess silicon rod cut about 5 mm.

The silicon rod with the sleeve was buried in the pocket that was made in the frontalis muscle; the forehead incision was closed with 6-0 polypropylene suture and the eyelid incisions were not sutured. We usually put the upper eyelid at a level of one mm. below the superior limbus, and in those patients with negative Bell's phenomena, 2 mm below.

After completion of the procedure, the eye was closed using Frost's suture (3 mm from the central lower lid margin using 3.0 Prolene), and the eye was patched with a chloramphenicol 1% antibiotic ointment for 24 hours.

The patient was kept on injectable 3rd generation cephalosporin for the 1st postoperative day, and then discharged the next day on an oral antibiotic for five days, lubricating artificial tear gel four times daily and a local antibiotic ointment chloramphenicol 1% at bed time for 10–14 days. Post operation, after the removal of the sutures, the patients were instructed to perform lid and eyebrow exercises for two months.

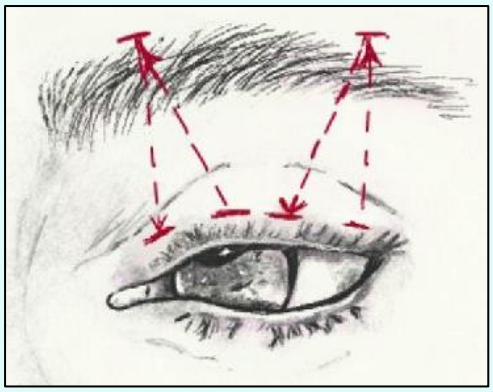
The patients were instructed to keep the eye closed and the lid elevated to the desired level by lifting their eyebrows using the frontalis muscle.

The patients were kept in regular follow up periods (after one week, one month, three months and six months to 1 year) in the postoperative period; the mean follow up period was six months.

Postoperative photographs of all our patients were taken during the follow up period to compare it with the preoperative photographs.

Postoperative evaluation was done by the assessment of the following criteria: -

1. Symmetrical eyelid position in case of unilateral ptosis.
2. Eyelid contour.
3. The way the upper eyelid pulls during upward gaze.
4. Recurrence of ptosis during follow up period.
5. Extrusion of Silicon rod.



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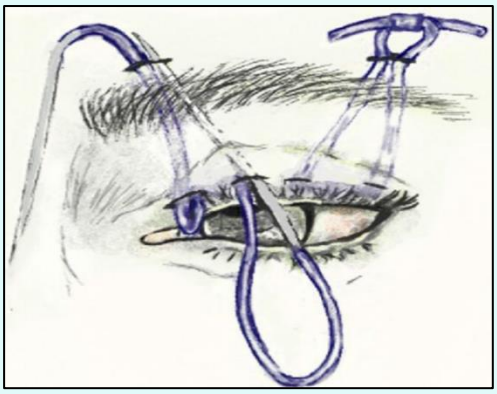

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Figure 1: A & B configuration of the Mehta's surgical technique.

Postoperative complications like persistent lagophthalmos, chronic keratopathy, suture granuloma, or lump development at the site of eyebrow crease.

N.B: M = male, F=female, Rt. = Right, L. = Left. * All measurements are in millimeter

Table 1: Study group characteristics

Patient	Age	Sex	Side	Levator excursion	Frontalis muscle excursion	Bell's phenomenon	MRD1	Ptosis Degree
1	10	M	Rt.	2	10	-Ve	-2	7
2	14	M	Rt.	3	10	+Ve	0	5
3	30	M	Rt.	3	9	+Ve	-1	6
4	4	F	Bilateral Rt., Lt.	3,2	10,10	-Ve	-1,-2	6,7
5	18	F	Lt.	3	10	+ Ve	-1	6
6	7	F	Lt.	2	9	+ Ve	-2	7
7	6	M	Lt.	1	10	-Ve	-1	6
8	18	M	Lt.	3	9	+Ve	0	5
9	8	M	Bilateral Rt., Lt.	4,3	9,10	+Ve	0,1	5,4
10	5	M	Lt.	2	10	+Ve	0	5

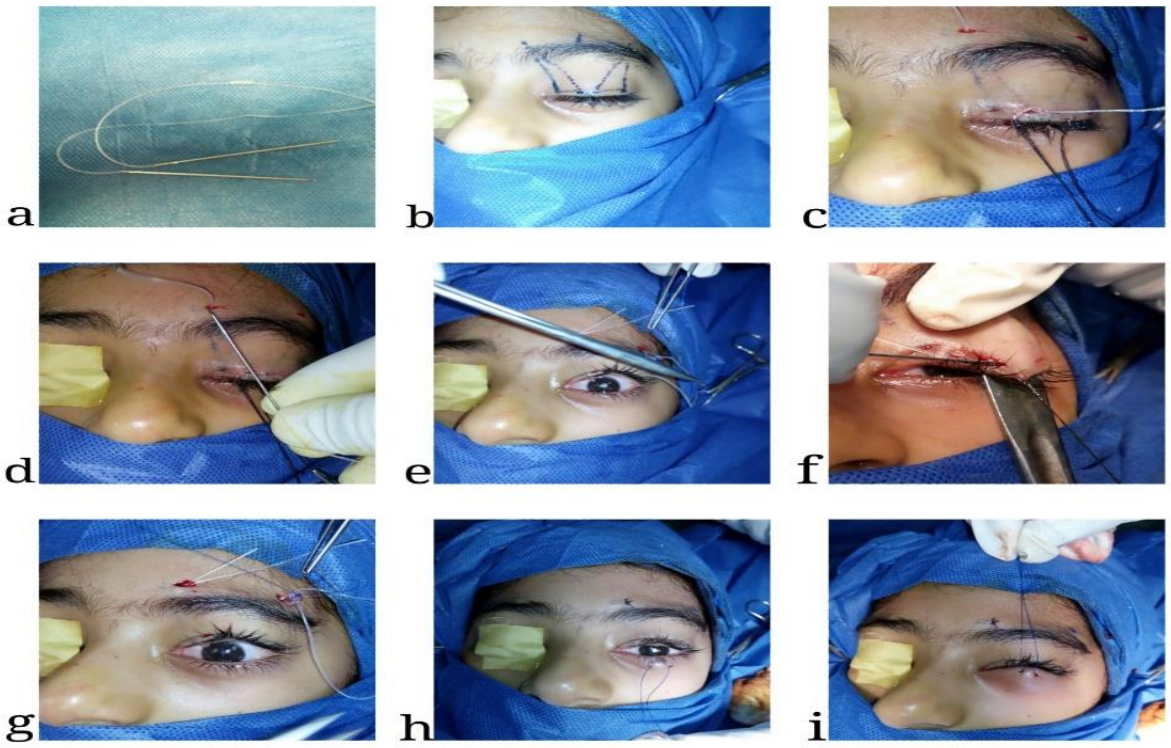

Figure 2: surgical technique for case no. 6 (a) silicon rod;(b) incisions planning;(c &d) incision made by passing the silicon needle to perform medial triangle; (e & f) lateral triangle accomplishing; (g) fixation of the 2 ends by sleeve after the adjustment is performed;(h & i) closure of the forehead incisions, with Frost's suture is applied and holding the stitch in the forehead after ointment application.

RESULTS

Nine patients (11 eyelids out of 12) had achieved nearly normal range of upper eyelid position (ranging between 1-3 mm) below upper limbus with full exposure to visual axis in comparison with normal eyelid. These patients had smooth eyelid contour without notching, with smooth upward eyelid movement without pulling away from the eye globe. When the early postoperative (1 month) and late postoperative (12 months) values of ptosis degree were compared, there was an improvement in the range of ptosis degree by 1–4 mm and 1–3mm respectively. The mean value for early postoperative ptosis degree was 2.6 mm, and the mean value for late postoperative ptosis degree was 2.3 mm.

Nine patients had no recurrence of eyelid ptosis or silicon rod extrusion. These patients were completely satisfied with their postoperative results. Case no. 8 had a recurrence of ptosis two months after the operation. This patient was later scheduled for silicon rod readjustment operation.

Our patients developed transient lagophthalmos of about 3 mm from lower lid margin, which was resolved within two weeks. None of the patients developed suture granuloma or lump at the site of incision. Also, none of them developed extrusion.

Tables 2–4 show the postoperative results with regards to lid level, MRD1, and lid lag. After three months post operation, we noticed that all of our patients acquired the adaptation to achieve adequate eyelid elevation with frontalis muscle assistance without being instructed to do so.

Table 2: One- month postoperative results. *

Patient	Lid level to the upper limbus without instruction to contract frontalis muscle	Lid level to the upper limbus with instruction to contract frontalis muscle	MRD1	Lid lag
1	3	1	2	3
2	3	1	2	0
3	3	2	2	2
4	4,3	4,3	1,2	2,3
5	3	2	2	0
6	1	1	4	1
7	2	1	3	1
8	4	2	1	2
9	2,1	1,0	3,4	2
10	2	1	3	2

*All values are in millimeters.

Table 3: Six-month postoperative results. *

Patient	Lid level to the upper limbus without instruction to contract frontalis muscle	Lid level to the upper limbus with instruction to contract frontalis muscle	MRD1	Lid lag
1	1	1	4	1
2	1	1	4	0
3	1	1	4	0
4	2,2	2,2	3,3	0
5	2	2	3	0
6	2	2	3	0
7	1	1	4	0

*All values are in millimeters.

Table 4: Values of the (MRD1) during postoperative period. *

Follow-up period	Range	Mean
1 Month	1-4	2.8
3 Months	2-4	3.55
6 Months	2-4	3.63
1 Year	3-4	3.85

*All values are in millimeters.

Figure 3: Case no.6–7-year-old girl with severe left-sided ptosis with poor levator excursion pre- and post-operative results

Figure 4: Case no. 8 left-sided ptosis with poor levator excursion. Pre and 6 months post-operative result.

DISCUSSION

In this study, silicon rod was used as a frontalis sling (920µ size) to correct of severe ptosis with poor levator function in ten patients (12 eyelids). The design adopted was based on Mehta's modification of the Crawford technique, where he used a silicon rod in a two-triangle design. [10]

Our results showed that nine patients (11 eyelids) had satisfactory postoperative results with good symmetrical eyelid position with smooth curves without central focal notching in the upper eyelid, no pull away of the upper eyelid in these patients during upward gaze of the eyelid. Also, there was no extrusion of the silicon rod seen in those ten patients.

One of our patients had unsatisfactory results, with recurrence of ptosis after one-month post operation. This patient had to undergo another silicon rod readjustment operation after 6 months. In general, our study is consistent with the study by Susan R. Corter et al., [11] where they used silicon rod in 35 cases (61 lids) with severe ptosis and poor Levator function, and achieved good to excellent final lid height in 61 lids, with the recurrence of ptosis in four lids (7%). Lee et al found in a three-year follow up study that the recurrence rate of the frontalis sling was 11% for the silicon rod group and 41% in the fascia Lata group, and they confirmed that better results are achieved in the silicon rod instead of fascia Lata. [12]

In our study, there was no suture granuloma and infection, or lump noticed in any of our patients. We prevented the incidence of lump formation of the suture by cutting the two ends of the rod and burying them deep into the frontalis muscle and suturing over it.

Considering the previously published articles, Barry N. et al found that suture granuloma and infection occurred in 7.7% of patients where monofilament nylon was used, 9.1% with braided polyester, 45.5% with ePTFE, and 0% with polypropylene. [7]

All our patients had transient lagophthalmos, which was resolved within 10 days to two weeks after resolution of edema, except in one patient where it lasted about four weeks. As its elastic nature reduces the risk of lagophthalmos compared with non-extensible materials and its behavior is highly predictable. [13]

We also found an improvement of the lid level with time after the operation, as the patients learn how to use the frontalis muscle for the elevation and adjustment the level of the eyelid.

No (cheese wiring) effect occurred in our study, which may be noticed in other suture material; since the silicon is thick and not sharp to cut through tissue planes. The cheese wiring effect is due to the cutting of suture materials throughout the tissue, which leads to ptosis recurrence. Regarding the sling material for frontalis suspension, cable suture slings (nylon, supramid, prolene, silk) have a high rate of complication such as suture granulomas and ''cheese-wire'' effect. [13, 8]

The use of the silicon rod is not associated with donor site morbidity and can be used in children below four years of age where the tensor fascia Lata graft is not appropriate because it is not well developed.

Also, one of the advantages of using of silicon rod is that when the patient needs the readjustment of his or her eyelid position, this can be done probably by putting the supraorbital region under local anesthesia with a nerve block or local infiltration or a

combination of both in adults with no further dissection, reducing the cost and the time of operation.

In our study, Mehta's modification of the Crawford technique seems have several advantages over the other most commonly used designs; since it is a much simple operation, with better control adjustment of the eyelid, as it facilitates the adjustment of each side of the eyelid i.e., lateral and medial sides separately so it gives us better control on the eyelid adjustment with no focal central notching or ectropion in comparison to other designs e.g., Fox or modified Crawford technique. In the modified Crawford technique, 19.2% of patients developed focal central notching with mild ectropion, while in the Fox group, it was about 3.8%. [(14)]

In addition to that, Mehta's modification of Crawford technique gives a nice eyelid crease, with a negligible forehead scar.

This method is not costly in comparison with the double rhomboid pattern, which was used by Goldberger S. et al. [(15)] since it used two silicon rods for each eyelid, increasing both the cost of surgery and the risk of formation of granuloma.

CONCLUSIONS AND RECOMMENDATION:

Mehta's modification of Crawford technique for frontalis sling surgery using silicon rod for the treatment of severe ptosis with poor levator excursion is an easy, simple, and predictable procedure with good postoperative results in terms of good contour of the eyelid, nice placement of the eyelid fold, no focal notching, minimal lagophthalmos, and negligible forehead scar. We recommend a long-term follow-up period and larger number of patients in order to get a more precise evaluation of the procedure.

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