

Conventional versus Modified Tarso-frontalis Suspension Surgery using Targeted Lid Crease for Simple Congenital Blepharoptosis with Poor Levator Action

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ABSTRACT

Introduction: The routine technique of tarso-frontalis suspension surgery for simple congenital blepharoptosis with poor levator action is cosmetically less rewarding due to either an absence or asymmetry of the postoperative eyelid crease. The objective of this study was to assess the eyelid crease quality after a modified open method of tarso-frontalis suspension surgery compared to the closed method.

Materials and methods: This was a retrospective comparative study reviewing the case sheets of all the patients undergoing unilateral tarso-frontalis suspension surgery with silicon rod employing Fox pentagon design from September 2017 to February 2019 at Mechi Eye Hospital, Jhapa, Nepal. A review of 40 case sheets of congenital lid ptosis with poor levator function (<4mm) aged 9 years or more was done. Tarso-frontalis suspension surgery, modified with a mini blepharoplasty incision, direct attachment of silicon rod to tarsus, completion of pentagon design with supra-brow incisions, and skin-orbicularis-tarsus-orbicularis-skin suture (open method) was done in 20 cases whereas other 20 cases underwent surgery with supraciliary stab incisions (closed method).

Results: The mean age of the patients was 21.1±5.9 years (range 9-30 years). The ptosis amount ranged from 3–10mm. At the 6th postoperative month, most of the cases had good ptosis correction (90% open group, 85% closed group, p=0.74). However, cosmetic outcomes were better in the open group compared to the closed group: 100% symmetrical eyelid crease compared to 40% (p<0.001) and 90% acceptance rate for eyelid contour compared to 70% (p=0.23).

Conclusion: Predictable, targeted, and symmetrical lid crease can be obtained using the modified open method of tarso-frontalis suspension surgery.

Key words: Congenital blepharoptosis, Lid crease, Tarso-frontalis suspension surgery.

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INTRODUCTION

Simple congenital blepharoptosis is unilateral or bilateral drooping of upper eyelids since birth which is usually associated with degenerative disorder of Levator Palpebrae Superioris (LPS) muscle (Nerrad, 2001) or failure of innervation of LPS by the superior branch of oculomotor nerve (Traboulsi, 2004). Almost 90% of blepharoptosis are congenital and the incidence of congenital ptosis is one in 842 births (Griepentrog et al, 2011). Indications for surgery are either functional (risk of amblyopia or superior visual field obstruction) or aesthetic.

Tarso-frontalis suspension surgery (TFSS) (or frontalis sling surgery) is the most frequently performed surgical technique for severe congenital ptosis with poor LPS function ($\leq 4\text{mm}$) (Wagner et al, 1984). In this technique, the tarsus of the droopy eyelid is suspended to the Frontalis muscle of the forehead using a suspension material in a predefined suspension design. The suspension material in TFSS can be either autologous such as fascia Lata, palmaris longus tendon, umbilical vein, and frontalis muscle or exogenous such as Prolene suture, silicon rod, silk suture, nylon suture, stainless steel rod, Supramid suture, etc. Designs could be single or double triangle, single or double rhomboid, or single or double pentagon (Crawford, 1956; Fox, 1967; Friedenwald & Guyton, 1948). Further, the design of tarso-frontalis suspension can be completed by either using supraciliary stab incisions only (closed method/ routine technique) or using a lid crease

incision and completed via supra-brow stab incisions (open method).

In contrast to the levator resection technique, TFSS often presents as a cosmetic challenge to ophthalmic plastic surgeons due to the unpredictable lid crease due to the poor LPS action. Thus, the question remains - Is a good lid lift in ptosis surgery enough? What about the lid crease? Can we get a predictable and targeted lid crease in TFSS? To answer these questions, we modified the open technique of TFSS and compared it with routine closed technique with regards to the lid crease formation and symmetry in cases of congenital blepharoptosis with poor levator function.

The objectives of the study were to assess the functional and cosmetic outcomes after the modified open method of TFSS compared to the routine closed method.

MATERIALS AND METHODS

This was a single-center, single-surgeon, retrospective comparative study comparing the cosmetic and functional outcomes of two methods of TFSS. Case sheets of all the patients aged 9 years or more undergoing TFSS using silicon rod as suspension material and Fox pentagon technique as suspension design for unilateral congenital ptosis ($>2\text{mm}$) with poor levator function ($\leq 4\text{mm}$) from September 2017 to February 2019 (1.5 years) at Mechi Eye Hospital, Jhapa, Nepal were reviewed. The exclusion criteria were, bilateral moderate to severe ptosis, bilateral ptosis surgery, associated

strabismus, poor Bell's phenomenon, jaw winking phenomenon, blepharophimosis syndrome, history of trauma, good levator function (>4mm) and mild ptosis of 2 mm or less. Patients who were 8 years or below were operated under general anesthesia by a pediatric ophthalmologist and hence, excluded from this study.

A total of 72 cases of tarso-frontalis suspension surgeries were performed over the duration of study. However, 12 patients had bilateral ptosis surgeries (same or different settings), 19 patients did not complete six months follow-up and one patient had blepharophimosis syndrome and thus were excluded from the study. Out of the remaining 40 cases, twenty cases had an open method of surgery, whereas the other 20 cases had undergone routine technique.

Demographic data were recorded, and a complete ophthalmic examination was done. Ptosis assessments included vertical fissure height in primary position (VFH1), upgaze (VFH2) and downgaze (VFH3), Upper

Margin Reflex Distance (MRD1) and lower (MRD2), levator function, amount of ptosis, Bell's phenomenon, orbicularis oculi function, extraocular motility, jaw winking, presence or absence of lid crease and lid crease distance. A preoperative photograph in the primary position of gaze was taken for all the patients.

After painting and draping, markings were made in the surgical sites. In the open method group, a mini blepharoplasty incision at the intended lid crease site, corresponding to the lid crease height in the other eyelid, was made to expose the tarsal plate. Silicon rod was then sutured at the junction of upper one-third and lower two-third of the tarsus and secured with polypropylene 5-0 sutures (Figure 1). Fox pentagon design for the tarso-frontalis suspension was completed using supra brow stab incisions. After achieving the desired lid height and contour, closure of the wound was then fashioned to form a hard lid crease by using a skin-orbicularis-tarsus-orbicularis-skin sutures with polyglactin 910 6-0 sutures with bites on the tarsus just above the silicon rod.



Figure 1: Modified open method showing the incision site and attachment of silicon rod to tarsus.



Figure 2: Closed method with supralash and suprabrow stab incision sites and completion of pentagon design.

In other group (closed method), 2 markings were made on the eyelid at 3-4 mm above the lash line, corresponding to the medial limbus and lateral limbus in the primary gaze and three suprabrow markings were made as in the open group (figure 2). The tarsus was then suspended to the frontalis muscle with a silicon rod in a Fox pentagon design. The skin was closed with Polyglactin 910 6-0 sutures after the desired lid elevation. Inverse Frost suture was applied to the lower eyelid with a Silk 4-0 for corneal protection in both groups.

All cases were evaluated on the first postoperative day to assess the surgical wound, lid elevation, lid edema, lagophthalmos and keratopathy. Topical eye drops (antibiotics and lubricants), topical antibiotic ointment and oral drugs (antibiotics and anti-inflammatory) were given to all the patients. The inverse Frost suture was kept for 7 days and then removed. Postoperative follow-up was called for 6 weeks, 3 months and 6 months after the surgery. Vertical Fissure Height in primary gaze (VFH1), Margin

Reflex Distance (MRD1 & 2) and lagophthalmos were measured in the follow-up visits.

The final outcome at 6 months was assessed by functional outcomes, cosmetic outcomes and complications. Functional outcome was assessed according to the criteria set by Yoon and Lee (2009), as stated below:

- Good: a difference of ≤ 1 mm in MRD1 between 2 eyes
- Fair: difference 1-2 mm in MRD1 between 2 eyes
- Poor: difference > 2 mm in MRD1 between 2 eyes

Combined objective and subjective approach were taken to define the cosmetic outcomes as below:

- Symmetrical lid crease: lid crease height within 2 mm of another eyelid
- Symmetrical lid contour: Subjectively by the patient as acceptable or not

Ethical clearance: This study was undertaken following the international norms and the terms of the Declaration of Helsinki of the World Medical Association. Ethical clearance was obtained from the Mechi Eye Hospital Board for the study.

Statistical analysis: Data was entered in Microsoft Excel 2016 (Microsoft Corporation, Redmond, Washington, USA) and statistical analysis was done using Statistical Package for Social Sciences version 25 (IBM, Chicago, Inc). For descriptive statistics, percentage, mean, standard deviation (SD), median and interquartile range was calculated along with the graphical and tabular presentation. For inferential statistics, chi-square test for categorical data and independent t-test for comparing normally distributed variables at different time points were applied to find out the significant differences between the groups and other selected variables. The test of significance was considered significant when the p-value was less than 0.05.

RESULTS

A total of 40 case sheets of patients with tarso-frontalis suspension surgery for congenital ptosis with poor levator function satisfying the inclusion and exclusion criteria were retrospectively reviewed. The mean age of the patients enrolled in this study was 21.1 ± 5.9 (9-30) years. The two groups had no significant differences with respect to age ($p=0.674$) as shown in Table 1.

Out of 40 cases, 22 were males (10 in open, 12 in closed) and 18 were females (10 in open and 8 in closed). Majority of the patients (27, 67.5%) were from India, 12 patients (30%) were from Nepal whereas 1 patient in the closed group was from Bangladesh. The preoperative ptosis amount ranged from 3–10mm. There was no significant difference in the two groups with reference to the preoperative ptosis amount ($p=0.329$), preoperative MRD1 ($p=0.633$) and preoperative LPS action ($p=0.593$) (Table 2). Thus, the preoperative characteristics of the two groups were statistically comparable.

Table 1: Age characteristics of the two groups.

Age	Open group	Closed group
Mean age	21.5 ± 7.1 (9-27) years	20.7 ± 4.56 (14-30) years

$p=0.674$

Table 2: Preoperative ptosis evaluation of the cases from the two groups.

Preoperative ptosis	Ptosis amount	MRD1	LPSA
Open group	5.7 ± 2.15	-1.9 ± 2.2	2.4 ± 1.18
Closed group	6.4 ± 2.33	-2.4 ± 2.0	2.1 ± 1.16
Open vs closed	$p=0.329$	$p=0.456$	$p=0.422$



Table 3: Functional outcome (ptosis correction) of the two groups

Ptosis correction	Open group	Closed group
Good	18 (90%)	17 (85%)
Fair	0 (0%)	1 (5%)
Poor	2 (10%)	2 (10%)

Table 4: Cosmetic outcome of the two groups.

Cosmetic outcomes	Open group	Closed group	p value
Symmetrical eyelid crease	20 (100%)	8 (40%)	p<0.001
Subjective acceptance of the eyelid contour	18 (90%)	14 (70%)	p=0.235

Postoperative lagophthalmos was present in all the cases on the first postoperative day (range 1-3mm) which decreased to ≤ 1 mm in 85% of the cases by 6 weeks.

Functional outcome: Majority of the cases had good ptosis correction at 6 months (90% open group, 85% closed group, p=0.74) as shown in Table 3.

One case in the open group and 2 cases in the closed group opted for surgical readjustment due to the poor ptosis correction.

Cosmetic outcome: The cosmetic outcomes at 6 months postoperative period were better in the open group as shown in table 4. All the cases in the open group had symmetrical eyelid crease compared to only 40% cases in the closed group, which was statistically highly significant (p<0.001). The static lid crease was formed at the site of incision in the open group whereas in the closed group it was either absent or formed but not at an intended site. Patients reported

better eyelid contour in the open group (90% vs 70%) compared to the closed group.

Three cases (2 in open group and 1 in closed group) had extrusion of the silicon rod, with granuloma formation in one case and wound infection in the other two. There were no cases of exposure keratopathy at 6 months' follow-up despite persistent lagophthalmos of up to 2 mm in 5 cases (4 in open group and 1 in closed group; p=0.342).

DISCUSSION

It was interesting to note that, there was no statistically significant difference in the two groups in terms of age which could have been one of the confounding factors for the outcomes after the surgical techniques. Both groups rendered good functional outcomes, however the cosmetic outcome, in terms of symmetry of the eyelid crease, was better after the modified open method of tarsofrontalis suspension surgery.

We used the Fox pentagon technique in our cases due to the relative simplicity of the technique and easier postoperative manipulations. Mehta et al. (2017) found that despite a better MRD1 increase in the Fox pentagon design compared to the Crawford double triangle design, both designs were equally effective in reducing the amount of blepharoptosis and achieving a natural appearing cosmetic outcome. We used silicon rod as the suspension material since they are exogenous inert materials which provide good tensile strength for longevity, yet adequate elasticity for the complete closure of the eyelid (Lamont & Tyers, 2010). They are commonly available and safe for frontalis suspension in patients with severe ptosis (Bansal and Sharma, 2015).

Postoperative functional outcomes

Galindo-Ferreiro et al (2017) compared the outcomes of two techniques of frontalis silicon sling surgery (open-65 eyelids and closed-90 eyelids) and found similar outcomes in both group - 50% success rate in open method and 51.8% in closed method. A similar study employing silicon rod in Fox pentagon design in congenital blepharoptosis with LPSA <4mm found that the functional outcomes were similar in both open and closed surgical groups. Good MRD (3-5mm) were found in 12 out of 22 surgeries in both the closed and open methods of surgeries (Etezzad Razavi et al, 2014). In our study, the majority of the cases had good ptosis correction at 6 months (90% modified open surgery group, 85% routine

closed surgery group) which is higher than that of the above studies. This could be due to our criteria for functional success which was good if postoperative MRD1 was within 2 mm of another eyelid. Also, we maintained the immediate postoperative lid level at above 1.5-2mm of the desired final MRD1.

Postoperative cosmetic outcomes

Razavi et al (2014) reported better cosmesis after open surgical technique than closed technique but without any significant changes in the final MRD results. They also found out that the symmetry of MRD and the lid crease was more prevalent in the open group. Similar study by Yagci & Egrilmez (2003) comparing the cosmetic results after frontalis sling operations with fascia lata for congenital ptosis with poor LPS action performed via an eyelid crease incision (open group) versus the supralash stab incision (closed group) found that eyelid symmetry was acceptable in 46.6% in closed groups and 76.6% in open groups. Thus, they concluded that the open technique could be functionally and cosmetically better than closed technique. Another study by Galindo-Ferreiro et al (2017) found eyelid crease abnormality in 5.9% of the cases with closed TFSS compared to none in the open group. Our study results are consistent with the above studies with better cosmetic outcomes in the open group. However, all the cases in the open group in our study had symmetrical eyelid creases which is an excellent result. Lid crease formation in our technique was due to skin-orbicularis-tarsus-

orbicularis-skin sutures, thereby creating a hard (static) crease and not merely due to the scarring from skin incision. The better lid contour in our study could also be attributed to the equally distributed pull through the upper tarsus.

Complications

Under-corrections were more frequent with the open method whereas granulomas were more frequent in the closed method (Galindo-Ferreiro et al, 2017). Razavi et al (2014) reported more under-corrections in the open group (45.5%, 10/22) compared to the closed group (40.9%, 9/22). However, in our cases, the final lid height was comparable in both methods. Most important cause of under correction in the open method is the silicon rod migration from the attachment at the upper tarsus despite suturing. In our study, a silicon rod was secured onto the tarsus by 3 non-absorbable sutures which was further strengthened by a hard crease suture just above it, probably leading to comparable lid height with the closed group.

In our study, there were 3 cases of silicone rod extrusion but no cases of exposure keratopathy. Galindo-Ferreiro et al (2017) reported 13.3% cases of exposure keratopathy in the open method group and 23.5% cases in the closed method group. The reason for no

exposure keratopathy despite 5 cases of mild lagophthalmos (0-2mm) in our study could be due to the “Think and Blink” exercises and lid taping at night alongside frequent preservative free ocular lubricants.

From this study, we can suggest that the modified open method of tarso-frontalis suspension surgery renders targeted lid crease after surgery leading to better cosmetic acceptance. However, this study is limited by the small number of samples, retrospective study, and lack of a long-term follow-up. Thus, a large sample prospective randomised control trial comparing the outcomes after the two techniques of tarso-frontalis surgery is recommended.

CONCLUSION

Although both the modified open method and closed method of Tarso-frontalis suspension surgery yielded good functional outcomes, predictable and targeted lid crease could be obtained in the open surgery group modified with a mini-blepharoplasty lid crease incision and skin-orbicularis-tarsus-orbicularis-skin suturing which resulted in better aesthetic acceptance by the patients.





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