ORIGINAL ARTICLE

Efficacy of Silicone Sling and Polypropylene (prolene) in Correction of Congenital Blepharoptosis by Frontalis Suspension

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Abstract:

Aims & Objective: To compare the cosmetic and functional results of frontalis suspension in congenital blepharoptosis using Silicone sling versus polypropylene. Materials and Methods: A retrospective study, that was conducted at tertiary care hospital from 1st January 2018 to December 2021, thirty two patients with age ranging from 5-50 years, with congenital ptosis having levator function of 4 mm or less were randomly divided into two groups: Group I (which included 16 patients who underwent frontalis brow suspension using silicon rod) and Group II (which consisted of 16 patients who underwent frontalis brow suspension using prolene). After proper pre-operative assessment frontalis brow suspension was performed under general / local anaesthesia. Post-operative cosmetic results, recurrence rates and associated complications were compared between these 2 groups. Final results were taken to be those at 1 month, 6 months' post-operative. Results: The mean age of the silicone group was 26.4 ± 18.6 years while it was 26.6 ± 21.4 years for the prolenegroup. There was a male predominant distribution in both groups (9:1 silicone, 7:3 prolene). The mean late postoperative margin reflex distance (MRD) and palpebral fissure height (PFH) for silicone group was1.76 ±1.02, 9.45±2.34 while for the prolene group was0.65±0.54 , 6.56± 2.74 respectively . Patients in silicone group had significantly higher PFHs (P<0.0001) and (P< 0.005) as well as MRDs (P<0.0007) and (P< 0.054) at 6 month and 1 months postoperatively compared to those in prolene group Good cosmetic success graded by lid contour, symmetry, and crease in the silicone group was recorded in 81.25% (13/16), 56.25% (9/16), and 68.75% (11/16) of patients, respectively.In the prolene group, 56.25% (9/16) of patients experienced good outcomes in both contour and symmetry. However, 43.75% (7/16) of this group had good crease outcomes.Frontalis brow suspension showed significantly good cosmetic and functional results using silicone tube (93%) as compared to prolene (69%). Conclusion: The established treatment for ptosis with poor levator function is frontalis sling suspension surgery. The upper ptotic lid is attached to the frontalis muscle and the lid is elevated actively on elevating brow. The use of silicone rod in tarsofrontalis sling surgery for congenital ptosis repair is a safe and effective surgery, with few complications and easy removal and adjustment.

Key words: *Congenital Blepharoptosis, Frontalis Brow Suspension, Silicone Sling, Polypropylene*

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Introduction

Ptosis of the upper eyelid is a condition in which the upper eyelid margin is in an abnormal inferiorly displaced position[1]. It may cover a significant portion of the cornea and pupillary aperture so as to cause visual impairment. Congenital blepharoptosis results from a developmental dystrophy of the levator muscle of unknown aetiology. It may be associated with third nerve misdirection, Marcus-Gunn jaw-winking phenomenon or blepharophimosis syndrome.[1] Congenital ptosis is a condition characterized by droopy eyelids with reduced levator function (LF), lid lag on down gaze, or an absent lid crease. The child might adopt a compensatory abnormal head posture (usually chin up) and is at risk of developing amblyopia. Children

whose LF is poorer than 4 mm are candidates for frontalis suspension surgery.

Crawford modified Wright's technique of frontalis suspension [2,3] using fascia lata (FL) in 1956 for use in children >3 years.

However,Fascialata(FL)harvesting can be technically difficult to some ophthalmologists, and the insufficient amount harvested has led to alloplastic synthetic materials such as silicone rod (SR),[4] silastic (silicone elastomer) ,[5] nylon, polyester,[6] and polypropylene [7,8,9] to be continually developed and used as sling materials. These would by pass the complications of additional leg surgery and possible postoperative morbidity.

To date, FL and SRs have been used with much success in the treatment of congenital ptosis. A recent study by Lee et al found better cosmetic results and lower recurrence rate with SRs compared to preserved FL in a Korean population.[10] Their study included adults and different surgical techniques when suturing both materials.

We present the surgical (functional and cosmetic) outcomes in a series of 32 eyelids in 28 patients with poor LF (<4 mm) who underwent frontalis suspension surgery using non-autogenous silicon rod and prolene as the suspensory material. Complications and recurrence of ptosis after correction are also presented.

Aims :

To evaluate the functional and cosmetic outcomes of frontalis brow suspensionusing Silicone sling or polypropylene in congenital ptosis.

Methods :

A retrospective study, that was conducted at tertiary care hospital from 1st January 2018 to December 2021, thirty two patients with age ranging from 5-50 years, with congenital ptosis having levator function of 4 mm or less were randomly divided into two groups: Group I (which included 16 patients who underwent frontalis brow suspension using silicon rod) and Group II (which consisted of 16 patients who underwent frontalis brow suspension using prolene). After proper pre-operative assessment frontalis brow suspension was performed under general / local anaesthesia. Post-operative cosmetic results, recurrence rates and associated complications were compared between these 2 groups. Final results were taken to be those at 1 months, 6 months post-operative and those with Marcus Gunn jaw winking were excluded from the study.The parameters under study were: palpebral fissure height (PFH), marginal reflex distance (MRD), best-corrected visual acuity, and associated strabismus.

Outcome measures of functional success were graded asgood improvement in MRD (> 3 mm) ,moderate improvement in MRD (> 2 mm to < 3 mm) and poor MRD (< 1.5 mm). Measurements were taken with the child looking in primary position and without frontalis recruitment.

Cosmetic outcome was assessed according to eyelid symmetry, contour, and lid crease formation. It was graded as''Excdellent'', "Good" or "Poor" as observed by a single independent assessor based on photographs at six months postoperative. Complications associated with surgery and recurrence of ptosis were also reviewed.

Options for surgical correction would be discussed with the family with the emphasis that early eyelid elevation would maximize visual development and avoid amblyopia.

Frontalis suspension :

Three incisions were made. Two were located at the medial head as well as the lateral tail end of the brow. The third was located on the forehead above the pupil. A subfrontalis pocket was dissected down to the level of periosteum and judicious hemostasis was applied, taking care to avoid skin edges.

A lid crease incision was made (either at 5 mm or matching the contralateral lid crease), and the pretarsal orbicularis was removed to expose the tarsal plate. The lid incision was closed using 7.0 vicryl sutures with lid crease formation (6.0 vicryl). The brow incisions were closed in layers after titration of the lid height and contour to an

acceptable level.

Statistical analysis :

Independent t-tests were used to compare baseline age, sex, and preoperative MRD, and PFH between the two different suspensory materials. Wilcoxon signed rank test was applied for MRD and PFH of the two suspensory materials preoperatively and at 1 and 6 months postoperatively. Mann–Whitney U-test was used to evaluate the functional and cosmetic outcomes between the two groups. Statistical analysis was performed using GraphPad Prism Version 7.0a and SPPS 19.0 (GraphPad Software, Inc., La Jolla, CA, USA).

Results :

A total 32 eyelids were studied; 50% (16/32) of eyelids had silicone and 50% (16/32) had prolene as the suspensory material (Table 1).

Table I : Patient demographics

Variable	Silicone (n=16)	Prolene (n=16)	P-value
Age , years (mean+SD)	26.4 ± 18.6	26.6 ± 21.4	0.46
Range	7 - 45	5- 50	
Sex distribution Male:Female	9:1	7:3	0.89
Preoperative MRD	0.28 ± 0.88	-0.03 ± 0.85	0.67
Preoperative PFH	4.95 ± 2.23	3.93± 1.45	0.08
Preopreative LF	3.22±1.22	2.35±1.48	0.53

Data are mean ± SD.

MRD=Marginal reflex distance; PFH=Palpebral fissure heigh; LF= Levator function

Mean ages were 7.1 (range 7–45) and 7.2 (range 5–50) years for the silicone and prolene groups respectively.

There was a male predominant distribution in both groups (9:1 silicone, 7:3 prolene). No significant differences in MRD, PFH, and LF were detected between the groups at baseline. Also, 25% of all patients (8/32) had amblyopia preoperatively; 12.5% (4/32) also had associated strabismus at presentation (esotropia and congenital nystagmus).

All of these patients underwent occlusion therapy and had their refractive errors corrected. None of them had significant visual deterioration in the 6 months postsurgery and maintained their preoperative visual acuity.

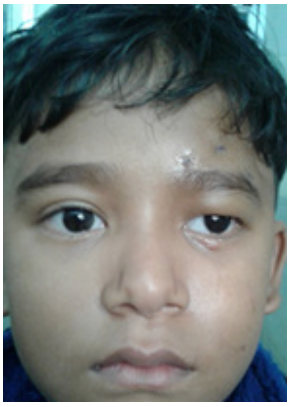
Average post-operative MRD was 1.76 ±1.02 mm in group I and 0.65±0.54 mm in group II at 6 months after surgery.Patients in silicone group had significantly higher PFHs (P<0.0001) and (P< 0.005) as well as MRDs (P<0.0007) and (P< 0.054) at 6 month and 1 months postoperatively compared to those in prolene group (Table 2)

Table II : 1- and 6-month post-operative MRD and PFH of silicone rod and prolene suspension

	Silicone rod	Prolene	P-Value
MRD (mm) 1 month 6 months	1.92 ±1.18 1.76 ±1.02	1.19±0.65 0.65±0.54	0.054 0.0007*
PFH 1 month 6 months	9.45±2.34 7.43±2.42	7.56± 2.74 5.58±1.55	0.005* <0.0001*

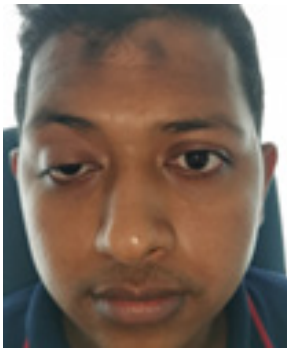
*Data are presented as mean ± SD. *P<0.01MRD=Marginal reflex distance; PFH=alpebralfissureheight.*

a) Preoperative

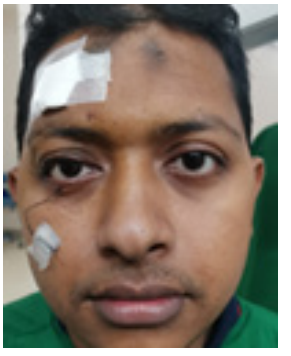


b) Postoperative

Figure 1: Preoperative and postoperative outcomes in frontalis suspension using prolene (Left eye)



a) Preoperative



b) Postoperative

Figure 2: Preoperative and postoperative outcomes in frontalis suspension using silicone rod (Right eye)

Postoperative outcomes:

Postoperatively in Group I, 15 (93 %) out of 16 had satisfactory results based on MRD, among which, 13 (81 %) patients showed good improvement in MRD (> 3 mm) and 2(12.5%) patients had moderate improvement in MRD (> 2 mm to < 3 mm). The remaining 1 (6.25%) of 16 patients had poor MRD (< 1.5 mm). In Group II, 11 (68.75%) out of 16 had satisfactory cosmetic and functional results. These patients exhibited good improvement in MRD (>3 mm). The remaining 5(31%) of 16 patients showed poor MRD (< 1.5mm). (Figure-3)

Good cosmetic success graded by lid contour, symmetry, and crease in the silicone group was recorded in 81.25% (13/16), 56.25% (9/16), and 68.75% (11/16) of patientsrespectively. In the prolene group, 56.25% (9/16) of patients experienced good outcomes in both contour and symmetry. However, 43.75% (7/16) of this group had good crease outcomes.(Table-3)

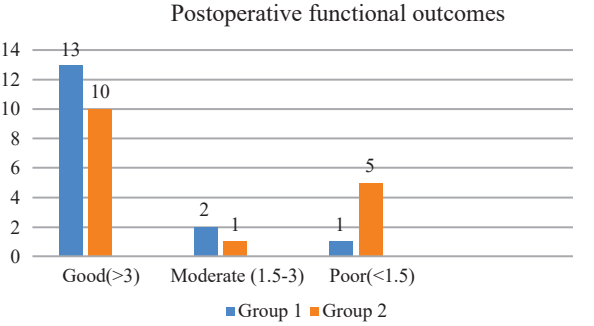


Figure-3: Results of Frontalis Brow Suspension using Silicone sling (Group I) andProlene (Group II) showing significantly better results in group I than Group II

Post-operative complications in Group I were as follows: 1 (6 %) out of 16 patients showed under correction of ptosis, 1(6 %) patient had granuloma formation,1 (6%) patient had exposure of silicone after six postoperative weeks,patient had recurrence of ptosis 1(6%) due to slippage of silicone. Post-operative complications in Group II were as follows: 5 (31%) out of 16 patients showed under correction of ptosis, over correction 2(12.5%) patient had recurrence of ptosis 3(18.75%) due to slippage of prolene,2 (12.5%) patient had granuloma formation,1 (6%) patient had exposure of prolene after six postoperative weeks. (Figure-2). The wound infections were treated with antibiotics and debridement, while the granulomas were self-limiting.

Table -III : Postoperative cosmetic outcome

	Silicone rod (n= 16)			Prolene(n=16)		
Cosmetic outcome	Excellent	Good	Poor	Excellent	Good	Poor
Lid contour	13(81.25%)	3(18.75%)	0	9 (56.25%)	3(18.75%)	4 (25%)
Lid symmetry	9 (56.25%)	4 (25%)	3(18.75%)	9 (56.25%)	3(18.75%)	4 (25%)
Lid crease	11(68.75%)	5(31.25%)	0	7 (43.75%)	2(12.50%)	6(37.50%)

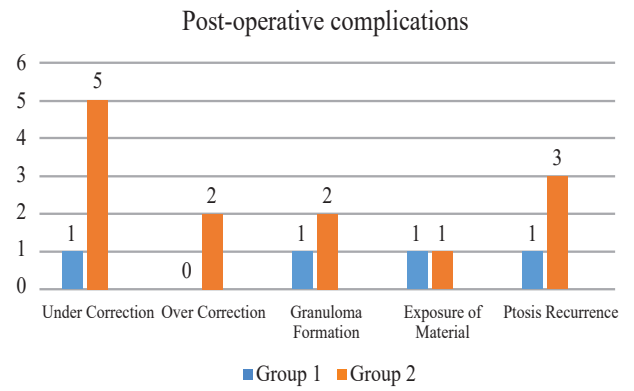


Figure-4: Indicates the post-operative complications encounteredin both the groups which have been more in Group II than Group I.

In the prolene group, one patient who had implant exposure problems underwent removal of rod implant and repeat surgery (due to ptosis recurrence) with prolene. This was unfortunately complicated by exposure problems again. Two patients (prolene group) had ptosis recurrence at 6 months after the procedure. In one patients, it was due to implant exposure and wound infection, while in the second patient, it was due to gradual weakening of frontalis suspension.(Figure-4)

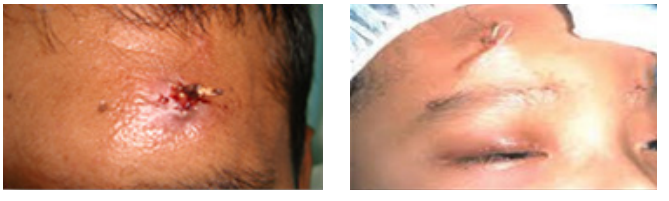


Figure 5: Photograph of patient showing granuloma, exposure to siling material

Discusion:

Most oculoplastic surgeons favor silicone rod for suspension surgery on young patients, as they are inert and easily obtained. This is especially advantageous in patients <3 years where there might be concerns about adequate lengths of fascia lata harvested2 or if early elevation of the eyelid is required to prevent amblyopia. The procedure can also be completed quickly as it bypasses the need for FL harvesting.[4,11,12]

However, the use of non-autogenousprolenecan lead to potential foreign body tissue reaction (such as granuloma formation), extrusion, and wound infection. This risk needs to be communicated to parents during preoperative counseling. However, the longer wound length might predispose to wound breakdown, especially in younger patients who tend to scratch their wounds. This can potentially account for a large proportion of postoperative complications. Wound dehiscence can, however, be minimized by meticulous wound closure and by ensuring deep tissue burial of the prolene material in the patient's brow.

In comparison, silicone rod are recognized as the ideal material for suspension, in part due to their ability to be fully integrated with excellent take.They also have a proven track record of good functional and cosmetic outcomes, and their long-term results have also been reported to be superior to any other nonautologous material.[13,14]

Yoon and Lee reported better functional and cosmetic results in pediatric congenital ptosis using SRs versus FL at 3 years follow-up postsurgery, but their study was limited to using preserved FL.[14] Banked FL was shown by Wasserman et al[8] to be associated with higher ptosis recurrence rates, compared to autogenous FL (4.2% versus 51.4%), though Esmaeli et al[15] reported good outcomes with reoperation rates at 21%–28%. They also noted that the recurrence rate was higher in those <3 years old.[8] Our study findings concur with those of other authors [14,16] who also used silicone rod in congenital ptosis with high functional success rates(87.5%) and had recurrence of ptosis (6%)

Olivia MacVie et al, (2013)[17] reported that twenty-seven patients (37 lids) were included in the study. The mean follow-up period was 71 months (range 2–173). There were 10 recurrences giving an overall success rate of 72.9%. The complication rate was 5.4%. Our studtyfinding concern with post-operative complications in Group I were as follows: 1(6 %) patient had granuloma formation,1 (6%) patient had exposure of silicone after six postoperative weeks,patient,Post-operative complications in Group II were as follows: 2 (12.5%) patient had granuloma formation,1 (6%) patient had exposure of prolene after six postoperative weeks

Syed Ali Raza Rizvi et al,(2014)[18] In cases of unilateral congenital ptosis, good results were seen in 83.3% cases, fair results in 11.1% cases, and poor results in 5.5% cases. In cases of bilateral congenital ptosis, good results were seen in 80.0% cases, fair in 15.0% cases, and poor result in 5.0% cases. Satisfactory postoperative eyelid elevation of ≥2 mm was seen in 93% cases. Complications in the form of granuloma formation, subsequent silicone rod extrusion, and recurrence occurred in 4% cases.Our study finding shown postoperatively in Group I (Silicone group), 14 (87.5%) out of 16 had satisfactory results based on MRD, among which, 12 (75%) patients showed good improvement in MRD (> 3 mm) and 2(12.5%) patients had moderate improvement in MRD (> 2 mm to < 3 mm). The remaining 1 (6.25%) of 16 patients had poor MRD (< 1.5 mm).

We obtained clinically significant functional and cosmetic improvement with lower complication rates in patients in whom frontalis sling procedure was performed using silicone (93 %) as compared to patients in whom prolene was used (68.75%). Large scale prospective studies are needed to evaluate the true outcome of different materials and sling designs in frontalis suspension surgery.

Conclusion:

Functional and cosmetic outcomes regarding MRD1, symmetry of lid height, lid crease were noted better in group 1 patients who underwent silicone sling surgery as compared to group 2 patients who underwent prolenefrontalis suspension surgery.

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