JOURNAL OF SURGICAL RESEARCH AND REVIEWS
2025; 2(1): 1-8.
10.5455/JSRR.20250115113925

ORIGINAL ARTICLE

Open Access

Silicone rod versus autogenous fascia lata for frontalis suspension surgery

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ABSTRACT

Aim: In this study, we aimed to assess the functional outcomes of the use of silicone rod (SR) versus autogenous fascia lata (AFL) for frontalis suspension surgery (FSS) and compare the results with each other.

Methods: The medical records of 36 eyes of 29 patients with blepharoptosis, who underwent FSS during 1999 and 2003 were retrospectively reviewed. Two groups were defined according to the sling material utilized in FSS; AFL group and SR group.

Results: A total of 29 patients were included in the study (mean range 9 months–28 years). Twenty-four eyes of 18 patients (mean age 12.2 years, range 4 years-28 years) were included in the AFL group and 12 eyes of 11 patients (mean age 5.6 years, range 9 months-12 years) were included in the SR group. The mean follow-up time was 16.4 months. AFL group yielded 91.7% satisfactory results with no recurrence in ptosis. In contrast, SR group yielded 83.3% satisfactory results and 16.7% recurrence in ptosis. In terms of satisfactory results, there was not a significant difference between the groups ($p > 0.05$).

Conclusion: Over the age of 3 years, we recommend AFL as the material of choice for FSS due to better functional results. However, in patients less than 3 years old and in selected cases who have the risk of postoperative exposure keratopathy, SR should be preferred due to the ease of management postoperatively.

ARTICLE HISTORY

Received January 15, 2025
Accepted February 13, 2025
Published February 23, 2025

KEYWORDS

Frontalis suspension surgery; blepharoptosis; autogenous fascia lata; silicone rod

Introduction

Blepharoptosis, commonly abbreviated as ptosis, is defined as an abnormal low-lying upper eyelid margin with the eye in primary gaze. Normally, the adult upper eyelid drops 1–2 mm below the superior limbus. Frontalis suspension surgery (FSS) is performed for the correction of severe ptosis with poor (< 4 mm) or absent levator function (LF) [1,2]. In this surgery, a sling material is used to attach the eyelid to the eyebrow and the power of the frontalis muscle is utilized to elevate the poorly functioning eyelid.

A variety of autologous and synthetic materials have been used in FSS. Synthetic sling materials include silicone, mersilene (polyester) mesh, expanded polytetrafluoroethylene (Gore-Tex), monofilament or polyfilament nylon, monofilament polypropylene (Prolene), and silk. Autologous materials include fascia lata autografts, banked/preserved fascia lata, the palmaris longus tendon, and the temporalis fascia [3]. The most frequently used autologous and synthetic options are fascia lata and silicone, respectively. In contrast to synthetic materials, autogenous fascia lata (AFL) is considered as the material of choice because of its long-lasting effect, good cosmetic and functional outcomes, and lower risk of recurrent ptosis. However, it has some pitfalls such as the difficulty of harvesting, the need for general anesthesia, a second surgical site (donor site) and its complications, and insufficient

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amounts in small children who are under the age of 3 years.

In this study, we aimed to report the functional outcomes of correcting blepharoptosis by FSS utilizing AFL and silicone rod (SR) and compare the results with each other.

Materials and Methods

The medical records of the 29 patients with unilateral or bilateral blepharoptosis with poor LF who underwent FSS between 1999 and 2003 were reviewed retrospectively. The surgical cases that were performed by a single surgeon (DY) at Ankara Education and Research Hospital were included in the study. A written informed consent was provided by all patients or their legal guardians. The patients recruited in this study were between 9 months and 28 years of age. There were two groups defined according to the material used in FSS (AFL or SR). The AFL group included 24 eyes of 18 patients aged between 4 and 28 years, mean age of 12.2 years and the SR group included 12 eyes of 11 patients aged between 9 months and 12 years, mean age of 5.6 years.

Preoperative data obtained from the patients' medical records included specific diagnosis, age, age of onset, laterality, and degree of ptosis, previous ptosis surgery, family history, associated systemic diseases, duration of follow-up, margin-reflex distance (MRD) measurement, and LF (In convenient cases). The MRD was measured with the eyelid(s) at rest, defined as the distance from the upper eyelid margin to the light reflex on the cornea. The LF was measured in mm in cooperated patients as the patient was moving his/her eye from a downward gaze to an upward gaze while negating the frontalis muscle action by pressing the thumb over the eyebrow. Lack of eyelid crease and ptosis that is covering the pupil was defined as the surgical indications for FSS in non-cooperated patients in whom LF could not be measured. AFL was preferred in patients over 3 years old. SR was preferred in patients under 3 years old, patients with motility problems (Congenital fibrosis of extra-ocular muscles "CFEOM" and third nerve palsy), and patients who did not approve AFL harvesting.

According to the etiology, there were 15 patients with simple congenital ptosis, 2 patients with traumatic ptosis, and one patient with blepharophimosis syndrome in the AFL group and 7 patients with simple congenital ptosis, 2 patients with third nerve palsy, 2 patients with congenital fibrosis of extra-ocular muscles in the SR group (Figs. 1 and 2). FSS was performed following the extra-ocular muscle surgery in patients with CFEOM and third nerve palsy and following double *Z*-plasty and medial canthal reconstruction surgery in patients with blepharophimosis syndrome.

Surgical procedure

All of the primary surgeries were performed under general anesthesia.

FL harvesting

A strip of FL 1 cm in width and 12–15 cm in length was harvested using a Crawford FL stripper from a line drawn from the iliac crest and the lateral tibial condyle. An approximately 5 cm skin incision was made to reach the iliotibial tract for harvesting. This strip was cut into smaller horizontal strips, each approximately 2–3 mm in width. Four to five strips could normally be obtained from the harvested FL graft. The thigh wound was subsequently closed in layers with 5.0 Vicryl for deep tissue and 4.0 Prolene in an interrupted fashion for the skin (Figs. 1 and 2).

FSS was performed with the Crawford technique in the AFL group patients and with the modified fox technique in the SR group patients.

Crawford technique

Three stab incisions about 2–3 mm from the lash line and reaching the tarsal plate were made. The central incision was in line with the pupil. The nasal and temporal incisions were at equal distances with the central incision and with nasal and lateral canthus. Two more stab incisions were made just above the eyebrow medially and laterally which are in line with the medial and lateral eyelid incisions. A forehead incision was made 1.5 cm above the eyebrow and this incision was in line with the middle of the

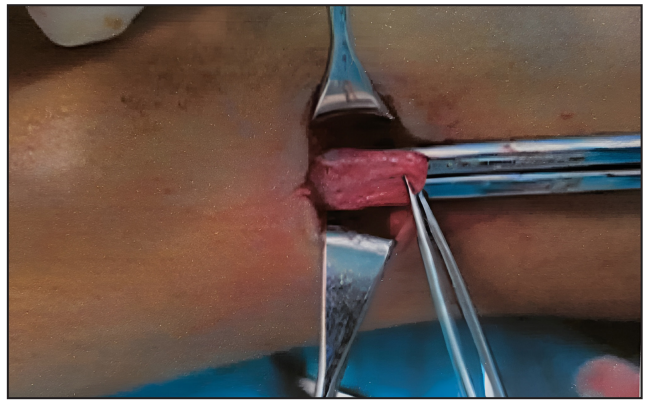

Figure 1. Harvesting AFL from the lateral side of the leg by using a stipper, a 4–5 cm skin incision is made.

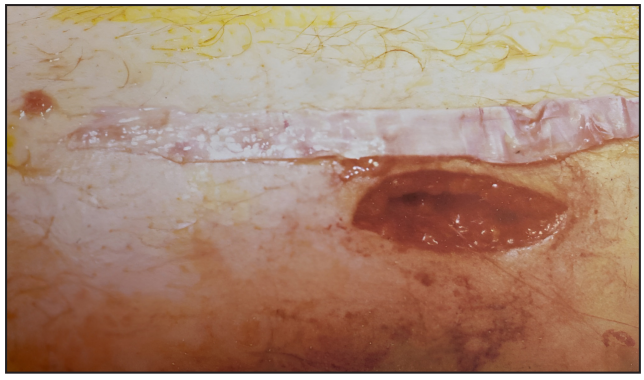

Figure 2. A fascia lata strip of 1 cm in width and 12–15 cm in length is obtained.

eyebrow incisions. Two FL strips were used in each eyelid. The strips were passed under the orbicularis muscle in the eyelid and over the periosteum above the eyebrow by using a Wright's needle. Two separate triangles with bases at the lid level and tops at the eyebrow were created using the FL strips. At the top of each triangle, the two tips of each strip were tied and one of the two tips was cut. The remaining tips of each strip were pulled through the forehead incision and knotted together after the adjustment of the eyelid level (when the lid height and contour were judged to be satisfactory). All of the incisions were closed with 6.0 Vicryl.

Modified fox pentagon technique

Five stab incisions, two in the eyelid 2–3 mm above the lash line, two in the upper edge of the eyebrow, and one 1.5 cm above the eyebrow in the midline, were made to create a regular pentagon. The SR was inserted deep into the orbicularis and frontalis muscles by using a Wright's needle. The two tips of the SR were secured by knotting with each other at the top of the pentagon in the forehead incision while adjusting the eyelid level. All of the incisions were closed with 6.0 Vicryl.

Systemic and topical antibiotics, systemic analgesics, and topical artificial tears were prescribed for all of the patients to use postoperatively.

Outcome measures

Outcome measures of functional success were defined according to the following criteria:

Satisfactory; lid height at the same level or only 1–2 mm lower than the other lid in unilateral cases and lids covering the limbus 3–4 mm maximally in bilateral cases and MRD ≥3 mm.

Undercorrection; Ptosis greater than or equal to 3 mm. The undercorrected patients had a revision surgery in the first postoperative visit.

Overcorrection; Lid retraction ≥2–3 mm. Lid massage was done for overcorrected patients and if lid massage was not sufficient, a revision surgery was performed.

Revision surgeries were performed under local anesthesia in adults and under general anesthesia in children.

Both groups were compared according to functional results, recurrences in ptosis, over and under corrections, and postoperative complication rates. Statistical analysis was made by using Pearson's chi-square test and Fisher's exact test to detect any significant differences in proportions. The p value of < 0.05 was considered as significant.

Results

A total of 29 patients and 36 eyes were included in the study; 24 eyes (18 patients) were in the AFL group and 12 eyes (11 patients) were in the SR group. The mean follow-up time was 16.4 months for both groups. Demographics and outcomes of these two groups are presented in Tables 1 and 2.

In the AFL group, 4 of 24 eyes (17%) had under-correction in which a revision surgery had to be done within the 1 week postoperatively. Overcorrection was seen in 1 eye (4%) and had a late revision surgery. Keratopathy related to lagophthalmus was seen in one patient and was treated with medicines. After revision surgeries, we had satisfactory results in 22 of 24 eyes (92%). A non-satisfactory but acceptable result was seen in 2 eyes (8%) of a patient with blepharophimosis syndrome. Due to the severe vertical shortening of the eyelids, a good cosmetic result could not be achieved in this patient. During the follow-up, none of the eyes had a recurrence of ptosis, infection, and/or granuloma formation. All patients had pain in the leg for 7–25 days (mean 10 days). One patient had hematoma at the harvesting site and was treated with elastic bandages (Figs. 3 and 4).

In the SR group, we had satisfactory results in 10 of 12 eyes (83%). Recurrence in ptosis due to loosening of the SR was seen in 2 eyes (17%). One of these two eyes had the diagnosis of congenital extra-ocular fibrosis and the other had third nerve palsy. SR exposure through the forehead incision was observed in one patient. This patient had a wound site infection which responded to oral antibiotics. In this patient, the tip of the SR was buried

into deep tissues. Overcorrection which necessitated a revision surgery was seen only in one eye (8%). Foreign body granulation tissue formation was not seen in any of the eyes (Figs. 5 and 6).

In terms of satisfactory results, there was not a significant difference between the groups ($p > 0.05$). In contrast, in terms of recurrence in ptosis, a significant difference ($p < 0.05$) was seen between the AFL and SR groups; 0% versus 17%, respectively. The other parameters, overcorrection/under-correction necessitating a revision surgery, and complication rates, were not significantly different between the groups ($p > 0.05$) (Table 3).

Discussion

Frontal suspension surgery is preferred commonly for correcting ptosis with poor LF. A sling material needs to be used to connect the frontalis muscle to the eyelid tarsus. For many years, surgeons have been in search of an ideal sling material by which a short operative time and a prolonged effect with fewer complications would be obtained. Many autologous and synthetic materials have been studied [3–5]. In this study, we compared AFL and SRs for FSS and tried to reveal the advantages and disadvantages of these materials.

In long follow-up periods, autogenous sling materials have been found superior to synthetic materials in terms of recurrence rates, surgical complications, and cosmetic results [1, 6–9]. In

Table 1. AFL group demographics and outcomes.

Patient no	Diagnosis	Age (years)	Eye	Previous Operation	Revision	Outcome	Complication
1	SCP	4	Left	+	-	S	-
2	SCP	11	Right	+	-	S	-
3	SCP	16	Right	-	Undercorrection	S	-
			Left	-	-	S	-
4	SCP	11	Right	+	-	S	-
5	SCP	6	Right	-	-	S	-
6	SCP	7	Right	-	-	S	-
			Left		-	S	
7	SCP	10	Right	+	-	S	-
8	SCP	7	Right	-	Overcorrection	S	-
9	SCP	8	Right	-	-	S	Keratopathy
10	SCP	13	Right	+	-	S	-
			Left	+	-	S	
11	SCP	28	Left	-	Undercorrection	S	-
12	SCP	11	Right	+	-	S	-
13	SCP	18	Right	+	-	S	Leg Hematome
			Left	-	-		
14	SCP	18	Right	+	-	S	-
15	SCP	7	Right	+	-	S	-
16	Traumatic Ptosis	25	Left	+	Undercorrection	S	-
17	BS	4	Right	-	-	S	-
			Left	-	-	S	-
18	BS	16	Right	-	-	A	-
			Left	-	-	A	-

SCP: Simple congenital ptosis.
BS: Blepharophimosis syndrome.
+: Yes.
-:No.
S: Satisfactory.
A: Acceptable.

Table 2. SR group demographics and outcomes.

Patient no	Diagnosis	Age (months/ years)	Eye	Previous operation	Revision	Final outcome	Complication
1	SCP	9 months	Right	-	-	S	-
2	SCP	11 months	Right	-	Overcorrection	S	-
3	SCP	2 years	Right	+	-	S	-
4	SCP	1 years	Left	-	-	S	-
5	SCP	1 years	Left	-	SR extrusion	S	Infection
6	TNP	11 years	Right	-	-	S	-
7	TNP	5 years	Right	-	-	R	SR Loosening
8	CFEOM	9 years	Right Left	- -	- -	S S	- -
9	CFEOM	12 years	Left	-	-	R	SR Loosening
10	SCP (Poor Bell's Phe.)	12 years	Right	-	-	S	-
11	SCP (Poor Bell's Phe.)	7 years	Right	-	Undercorrection	S	-

SCP: Simple congenital ptosis.
TNP: Third nerve palsy.
CFEOM: Congenital fibrosis of extra-ocular muscles.
+: Yes.
-:No.
S: Satisfactory.
R: Recurrence.

Figure 3. Preoperative photograph of a patient with severe ptosis.

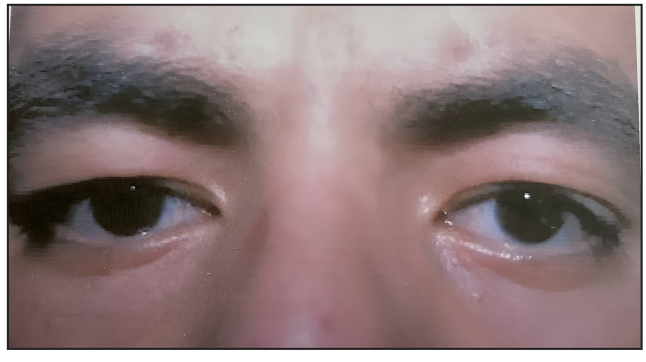

Figure 4. Postoperative photograph of the patient after FSS using fascia lata.

part, this is due to its ability to integrate into surrounding tissues fully and its low rate of rejection. [10–12]. AFL has a permanent effect, which should be taken into consideration in the timing of the surgery in selected cases in which an intervention is expected to be necessary in the future.

In their studies, Leibovitch et al. [11] and Lam et al. [13] used AFL and mersilene mesh in children under 3 years old for permanent suspension surgery and reported successful outcomes. Due to the difficulties in adjusting the eyelid level and the risk of exposure to keratopathy, we did not recommend AFL for children under 3 years old. Crawford suggested that AFL should only be used in patients over 3 years of age because inadequate amounts of material could be harvested in younger patients [2]. The main disadvantage of AFL surgery is the need for a second surgical site to harvest fascia lata and the possible risks of the donor site. Besides, fascia

lata may cause contracture of the upper eyelid, which can not be easily managed [2,14].

In this study, there was a significant difference in terms of recurrence in ptosis between AFL and SR groups. Thus, AFL yielded better results. In that, we recommend the use of AFL in FSS as the first line of therapy for ptosis patients in whom FL can be easily harvested.

Figure 5. Preoperative photograph of a child with severe ptosis.

Figure 6. Postoperative photograph of the patient after FSS using SRs.

Many surgeons prefer SR for FSS in young patients as it is inert, elastic, easily tolerated by surrounding tissues, and easily obtained [15,16]. This is especially important in patients under 3 years where adequate FL harvesting is difficult and early eyelid elevation is necessary to prevent amblyopia. The most valuable contribution of SR is its elasticity, which allows complete eyelid closure and appropriate eyelid height [15,17]. The ability to easily adjust the eyelid level through the forehead incision and easy removal from the body are the superior features of SR in patients with ocular motility problems (Myasthenia gravis, CFEOM, chronic progressive external ophthalmoplegia, and so on). Although there are a few studies in this group of patients where SR has been used, satisfactory results have been reported in patients with poor Bell's phenomenon and under 3 years old [15,18–20]. However, because it does not integrate with the surrounding fibrovascular tissue [10], this may cause slippage, resulting in the recurrence of ptosis [17,21,22].

Under the age of 3 years, nylon sutures have been used as a sling material as a temporary measurement but have high recurrence rates (25%–69%) and infection/granuloma formation rates (8% and 12%) [1,23,24]. The outcomes and complication rates are worse when compared with SR [1,6,24–27]. Thus, we can recommend SR as a preferable temporary sling material. Due to the elasticity of SR, eyelids can easily be closed after the surgery, which provides comfort, especially in small children.

In this study, our results in the SR group were in accordance with the previous literature. We recommend SR in selected cases such as poor Bell's phenomenon, third nerve palsy, and congenital fibrosis

Table 3. Comparison of outcomes and complications of AFL and SR in FSS.

	AFL (*n*:24 eyes)		SR (*n*:12 eyes)		*p* value
	N	%	*N*	%	
Satisfactory result	22	91.7%	10	83.3%	>0.05
Recurrence rate	0	0%	02	16.7%	**< 0.05**
Undercorrection/Revision	4	16.6%	1	8%	>0.05
Overcorrection/Revision	1	4%	1	8%	>0.05
Extrusion/Revision	0	0%	1	8%	>0.05
Infection	0	0%	1	8%	>0.05
Exposure keratopathy	1	4%	0	0%	>0.05

AFL: Autogenous fascia Lata; SR: Silicone rod.

of extra-ocular muscles where exposure keratopathy due to lagophthalmus is expected. We also consider that SR can be used more safely in these groups of patients.

The limitations of the current study are its retrospective design, the small number of patients included in the study, and relatively short follow-up period. Large-scale studies with longer follow-ups need to be done in the future.

Conclusion

Over the age of 3 years, we recommend the use of AFL as the first line therapy in ptosis surgery due to its potential for long-term good results. Under the age of 3 years, we recommend the use of SR in selected ptosis patients associated with ocular motility defects due to its temporary effect and also safety issues. Choosing the right sling material for the patient will help the surgeons achieve more satisfactory results.

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