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A Prospective Study of Paul Tessier's Technique in Paralytic Lagophthalmos Management

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ABSTRACT

Background: One of the most awful and serious disorders that can impact patients with facial palsy is lagophthalmos. It may result in multiple ocular complications like (conjunctivitis, keratitis, corneal ulceration, and vision loss). It can be treated by multiple procedures, including levator palpebrae superioris (LPS) muscle lengthening, which invented by Paul Tessier.

Aim of the study: The purpose of this study was to evaluate and assess the benefits and results of treating paralytic lagophthalmos by extending the upper eyelid's (LPS) muscle via aponeurosis interposition.

Patients and Methods: This prospective study included 15 patients with paralytic lagophthalmos (10 male and 5 female) and various causes of facial paralysis. With a mean age of 46.9 ± 15.2, the age group varied from 25 to 80 years old. All of the patients had one eye's levator muscle lengthened by aponeurosis interposition, as Paul Tessier describes it.

Results: Post-operative palpebral occlusion was complete in 13 patients (86.7%) and incomplete in 2 patients (13.3%). Most of patients experienced significant improvement of their ophthalmological symptoms after surgery. In all cases, the presence of the superior palpebral fold after surgery was found to be positive (100%). The aesthetic benefit was found to be satisfactory in all patients as well.

Conclusion: Treatment of paralytic lagophthalmos can be accomplished with favorable results in terms of both function and aesthetics by lengthening the (L.P.S) muscle using aponeurosis interposition, which is a straightforward, dependable, and reproducible operation.

Keywords: *facial palsy; lagophthalmos; levator palpebrae muscle; upper eyelid.*

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INTRODUCTION

One of the most uncomfortable and serious disorders that can impact patients with facial palsy is lagophthalmos. Multiple ocular disorders like conjunctivitis, keratitis, corneal ulceration, and vision loss result from the lack of ocular protection.[1-11]

Facial palsy treatment necessitates a multidisciplinary approach. If a spontaneous recovery is predicted, temporary procedures like as artificial tears, lid taping overnight, viscous ointments, temporary tarsorrhaphy and external weights of the eyelid are recommended. A permanent surgical option, such as permanent tarsorrhaphy, palpebral springs, levator muscle lengthening, upper lid weights, or dynamic techniques, such as temporalis muscle transfer or cross-facial nerve grafting, is indicated if recovery is being missed or incomplete.[2-8]

Paul Tessier described lagophthalmos as a lack of antagonistic relationship between the orbicularis oculi muscle and the upper eyelid levator in 1969. The (LPS) muscle is innervated by the common oculomotor nerve (III), not the facial nerve; hence it continues to function even if the facial nerve is injured. As a result of this imbalance, the levator becomes hyperactive leading to paralytic lagophthalmos.[4]

Paul Tessier was initially employed using aponeurosis interposition in order to "weaken" the upper eyelid the levator by lengthens it. Unlike a majority of other approaches, this one is based on lagophthalmos pathophysiology. It's reliable, straightforward, and easy to reproduce.[4]

Therefore, our study is designed to use a natural technique to achieve optimal functional and aesthetic results and avoid or minimize the possible complications of gold weight.

PATIENTS AND METHODS

This was a prospective non-randomized interventional study. It was carried out between September 2020 and September 2021, and included 15 patients (10 male and 5 female), with different causes of facial paralysis. The patients in this study were on average 50 years old (range, 25-80 years). All of the patients had one upper eyelid levator muscle lengthening with aponeurosis interposition, as described by Paul Tessier. We looked at the advantages and outcomes of this procedure.

Written informed consents for surgery, photography and publication of figures were obtained from all patients as well as the approval of institutional ethical committee.

Each patient was followed up for 3 months post-operative. Objective and subjective outcome analysis were done for all patients.

Inclusion Criteria:

Paralytic lagophthalmos (whatever the etiology), palpebral retraction greater than or equivalent to 2mm (in comparison to the healthy eye) and established facial nerve paralysis after all conservative treatments (six months).

Exclusion Criteria:

No obvious sign of retraction, past history of palpebral or oculoplastic surgeries, the third and fifth cranial nerves are both paralyzed at the same time, patients who were monocular and had one eye that wasn't working and dead or lost to follow up.

Preoperative Assessment:

Each patient was assessed according to the following items: laboratory assessment. (CBC, blood sugar, LFTs, KFTs, coagulation profile); ophthalmological examination regarding any associated ophthalmological symptoms (Redness, watery eyes, dryness, conjunctivitis, irritation, foreign body sensation), the eye's aesthetic appearance, palpebral fissure symmetry, eyelid mobility, acuity of vision, comfort in vision (in terms of frequency of treatment and possible complications), distance of palpebral retraction; and neurological examination and facial nerve study.

The Statistical Program for Social Science (SPSS) version 15.0 was used to analyze the data. The mean ± standard deviation (SD) was used to express quantitative data. Frequency and percentage were used to express qualitative data. The central value of a discrete set of numbers, namely the sum of values divided by the number of values, is called the Mean (average). The standard deviation (SD) is a measure of a set of values' dispersion. A low SD implies that the values are spread out over a wider range; whereas a high SD suggests that the values are close to the set's mean.

These tests were carried out as follow: When comparing two means, the independent-samples t-test of significance was used; When comparing non-parametric data, the Chi-square test was applied; P-value (probability); A P-value of less than 0.05 was judged significant; A P-value of less than 0.001 was deemed highly significant and P-values greater than 0.05 were deemed insignificant.

Operative Procedure:

Before we start the operation, width of the aponeurotic graft was identified while the patient in standing position. The aponeurotic graft was shaped like a rectangle, with a breadth that was twice that of the palpebral retraction. This retraction is calculated by subtracting the distance measured on the paralysed side between the upper edge of the constricted pupil and the inferior edge of the upper eyelid from the comparable distance measured in the healthy eye. The graft was roughly 2 cm long and adjusted to the patient's eye morphology (Figure 1).

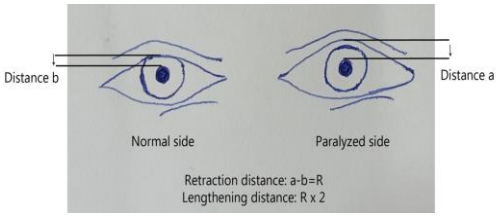


Fig 1: Comparison of distances between the healthy and paralysed sides.

In supine position after intravenous sedation and broad spectrum antibiotic (Ceftriaxone 1gm), the upper eyelid on the paralyzed side and the scalp in the contralateral side were subcutaneously injected with anesthetic agent (Xylocaine), 3 ml for the scalp and 1 ml for the upper eyelid. Also adrenaline in saline (1/200,000) was infiltrated into the same areas.

Through a temporal incision, the temporal aponeurosis was exposed to harvest the aponeurotic

graft. (Figure 2).

Fig 2: Through a temporal incision, a temporal aponeurosis graft is obtained.

The temporal region incision 2 cm behind the anterior hair line (2 cm in length). To guarantee proper measurements, the shape of the graft was

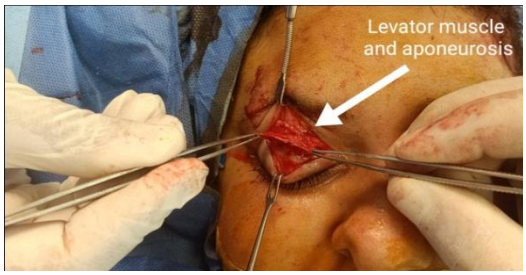
Plastic, Reconstructive Surgery and Burn

marked in ink with calipers. To assist graft harvesting, the temporal aponeurosis was infused with adrenaline in saline solution (1/200,000). The temporal aponeurosis was sectioned and excised

from the muscle with a scalpel (Figure 3).

Fig 3: Temporal aponeurosis graft (measuring 20mm).

Closure of the temporal incision in layers by (Vicryl 3-0) then dressing. The superior palpebral fold was used to make the upper lid incision. To separate the (LPS) aponeurosis from the eyelid levator, the upper margin of the tarsal plate was detected and dissected. The inner surface of the (LPS) muscle was then separated from the Muller's muscle by blunt dissection. And the assistant dragged the inferior edge of the (LPS) toward the lower part, and all



tissue was released by sectioning the medial and lateral horns high up (Figure 4).

Fig 4: For optimum release of the medial and lateral horns, traction on the (LPS) muscle of the upper eyelid downwards.

The graft was sutured with a few distinct stitches using bio absorbable suture material (Vicryl 5-0) round needle between the superior border of the tarsal plate and the inferior edge of the (LPS) muscle (Figure 5).

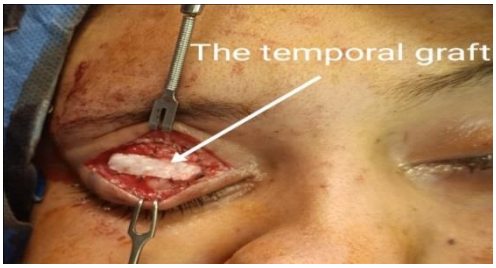


Fig 5: The aponeurosis graft is attached with a few spaced stitches. Before closing the skin, this is the final look. (The aponeurotic graft's width is R ×2).

The skin was stitched with nonresorbable suture (prolene 6-0). Then application of 3M Steri-strips 1/2" x 4", topical eye ointment (Dexatrol) and eye bandage.

Post-Operative Assessment & Follow up:

After operation the patient was lying in semi sitting position and was discharged from the hospital after stability of his condition. Prescription of topical antibiotic eye ointment, eye drops, (Dexartol) (Dexatobrin) and artificial tear eye drops (Refresh tears) for two weeks.

Follow up consultation:

A systematic follow-up consultation (6days - 15days - one month - 3months) will be conducted to evaluate the following: the degree of palpebral closure, while the patient is standing and lying down, the superior palpebral fold's existence, the palpebral fissure's symmetry, the improvement and the presence of any preoperative ophthalmological symptoms (Redness, watery eyes, dryness, conjunctivitis, keratitis.)

After three months, each patient was given a standardized questionnaire (Table 1) to complete in order to assess the following: aesthetic and functional outcomes, visual comfort before and after surgery (in terms of treatment frequency and potential complications) and patient satisfaction.

Name:
Age:
Sex
Face paralysis diagnosis date:
Surgery date:
Prior to Surgery
Were you experiencing any ophthalmological symptoms? YES/NO. If YES, which one? (Redness/Watery eyes/ Keratitis/ Conjunctivitis/ Dryness/ Others): (details):
Did you see an ophthalmologist on a regular basis? YES/NO
How many times a day did you have to apply treatment?
What grade would you give on a scale of 1 to 10 (1 poor, 10 excellent) for:
Is your eye aesthetically pleasing?
Mobility of your eyelid?
Are the palpebral fissures symmetric?

Your visual convenience (in terms of treatment frequency and potential complications)?
Following Surgery
Are you experiencing any ophthalmological symptoms? YES / NO. If YES, which one? (Redness/Watery eyes/ Keratitis/ Conjunctivitis/ Dryness/ Others): (details):
Did you see an ophthalmologist on a regular basis? YES/NO
How many times a day did you have to apply treatment?
What grade would you give on a scale of 1 to 10 (1 poor, 10 excellent) for:
Is your eye aesthetically pleasing?
Mobility of your eyelid?
Are the palpebral fissures symmetric?
Your visual convenience (in terms of treatment frequency and potential complications)?

Table 1: Questionnaire of Eyelid Levator Lengthening.

Results

Our study included fifteen patients of both genders (10 males and 5 females). Average age of patients was 46.9 (range, 25–80 years old) in this study (Table 2).

		Studied patients (N = 15)
Age (years)	Mean ±SD	46.9 ± 15.2
	Min - Max	25 – 80
Sex	Male	10 66.7%
	Female	5 33.3%

Table 2: All of the patients studied were described by their age and gender.

The (LPS) muscle of the upper eyelid was lengthened by aponeurosis interposition in all cases with various causes of facial palsy. (Table 3)

		Studied patients (N = 15)	
Causes of facial palsy	Bell's palsy	8	53.3%
	Congenital	1	6.7%
	Fracture base skull	2	13.3%
	middle ear Infection	1	6.7%
	Tumor excision	3	20%

Table 3: Description of causes of facial palsy in all studied patients.

According to our findings, the average width (lengthening) of the graft among the fifteen patients was 5.3 mm (range, 4–6 mm), and the length of the graft was roughly 2cm, tailored to the patient's eye morphology. (Table 4).

		Studied patients (N = 15)	
Width x length of the graft	4x20 mm	3	20%
	5x20 mm	4	26.7%
	6x20 mm	8	53.3%

Table 4: Description of graft width in all studied patients.

We were able to use 15 of the responses (from the 15 surveys) in the study. Ophthalmological problems were present in 9 patients (60%) after surgery, and ocular therapy was given three times each day. The treatment consisted mostly of physiological serum instillation (Physiodose), with no requirement for vitamin A in the evening. The mean value for visual comfort was 8.3/10 (4–10), and the value for eye aesthetic appeal was 9.1/10 (6–10) (Table 6; Figure 6, 8).

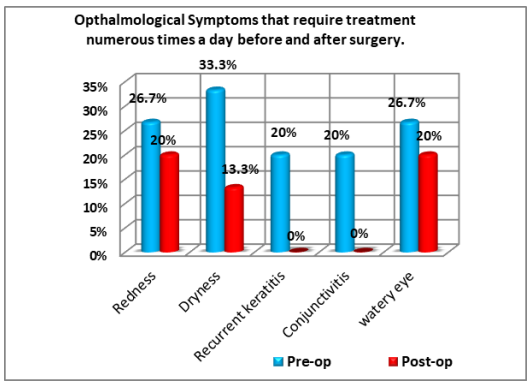


Fig 6: Ophthalmological symptoms that require treatment numerous times a day before and after surgery.

Before surgery, the average estimate for visual comfort was 5.6/10 (range 1–10), and the average estimate for eye aesthetic look was 5.6/10 (range 1–10). Other items of pre- and post-operative subjective assessment including mobility of the upper eyelid, visual comfort, symmetry of palpebral fissure and aesthetic appearance of the eye were assessed by the patients themselves, (Table 5, 6; Figure 7, 8, 9).

		Studied patients (N = 15)
Mobility of eyelid	Mean ±SD	3.8 ± 1.65
	Min - Max	1 – 7
Distance of palpebral retraction (mm)	Mean ±SD	2.66 ± 0.4
	Min - Max	2 – 3

Table 5: Description of pre-operative mobility of eyelid and distance of palpebral retraction in all studied patients.

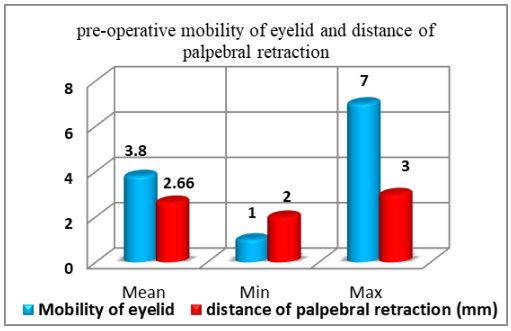


Fig 7: Description of pre-operative mobility of eyelid and distance of palpebral retraction.

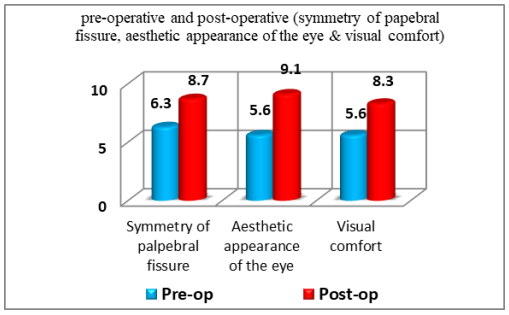


Fig 8: Comparison between pre-operative and post-operative (symmetry of palpebral fissure, aesthetic appearance of the eye and visual comfort).

		Pre-op (N = 10)	Post-op (N = 15)	T	P-value
Symmetry of palpebral fissure	Mean ±SD	6.3 0.9	8.7 0.8	7.7	< 0.001 HS
Aesthetic appearance of the eye	Mean ±SD	5.6 0.9	9.1 0.6	12.2	< 0.001 HS
Visual comfort	Mean ±SD	5.6 0.9	8.3 1.4	6.2	< 0.001 HS

Table 6: Comparison between pre-operative and post-operative (symmetry of palpebral fissure, aesthetic appearance of the eye & visual comfort) in all studied patients. T: independent sample T test; HS: p-value < 0.001 is considered highly significant. This table shows: High statistically significant difference (p-value < 0.001) between pre-operative and post-operative Symmetry of palpebral fissure. It was 6.3 ± 0.9 pre-operatively while it was 8.7 ± 0.8 post-operatively. High statistically significant difference (p-value < 0.001) was found between pre-operative and post-operative Aesthetic appearance of the eye. It was 5.6 ± 0.9 pre-operatively while it was 9.1 ± 0.6 post-operatively. High statistically significant difference (p-value < 0.001) was found between pre-operative and post-operative visual comfort. It was 5.6 ± 0.9 pre-operatively while it was 8.3 ± 1.4 post-operatively.

		Studied patients (N = 15)	
Post-operative presence of the superior palpebral fold	Negative Positive	0 15	0% 100%
Post-operative palpebral occlusion	Complete Incomplete	13 2	86.7% 13.3%
Post-operative residual lid retraction	Negative Positive	15 0	100% 0%

Table 7: Description of post-operative presence of the superior palpebral fold, palpebral occlusion and residual lid retraction in all studied patients. This table shows that post-operative presence of the superior palpebral fold was found in 15 patients (100%). Post-operative palpebral occlusion was complete in 13 patients (86.7%) and incomplete in 2 (13.3%) of the studied patients. Post-operative residual lid retraction was negative in 15 patients (100%).

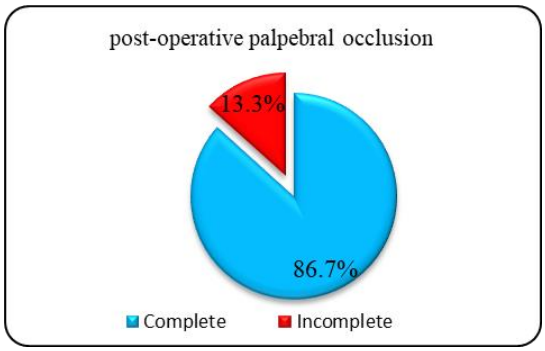


Fig 9: Description of post-operative palpebral occlusion.

In the follow-up consultations 3 months after surgery, whether the patient was standing or lying down, we found nearly full palpebral occlusion. There were no reports of keratitis or conjunctivitis. In addition, there was no visible swelling of the upper lid, as seen with gold plate implants, and all patients had the superior palpebral fold. As a result, in all cases, the symmetry of palpebral fissures was judged to be satisfactory. (Table 7; Figure 10, 11, 12, 13).

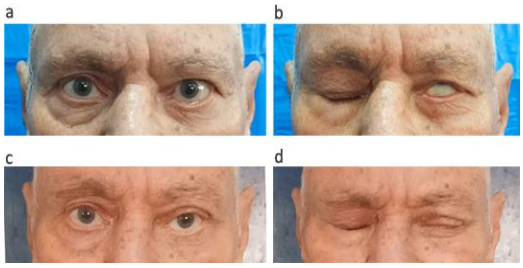


Fig 10: An 80-year-old male patient with facial nerve paralysis at the left side. (a) and (b) opening and closure of both eyes before surgical intervention reveals left lagophthalmos. (c) and (d) opening and closure of both eyes after levator muscle lengthening of the left upper eyelid with total eyelid closure.

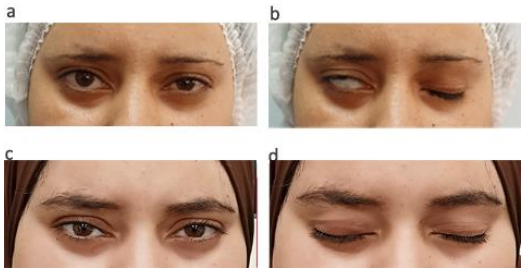


Fig 11: A 25-year-old female patient with idiopathic facial nerve paralysis at the right side. (a) and (b) opening and closure of both eyes before surgical intervention reveals right lagophthalmos. (c) and (d) opening and closure of both eyes after levator muscle lengthening of the right upper eyelid with total eyelid closure.

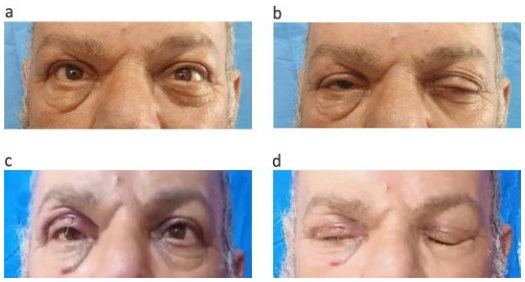


Fig 12: A 54-year-old male patient with facial nerve paralysis at the right side due to malignant otitis externa. (a) and (b) opening and closure of both eyes before surgical intervention reveals right lagophthalmos. (c) and (d) opening and closure of both eyes after levator muscle lengthening of the right upper eyelid with total eyelid closure.

Fig 13: A 40-year-old female patient with left congenital facial nerve paralysis. (A) and (B) opening and closure of both eyes before surgical interference reveals left lagopthalmos. (C) and (D) opening and closure of both eyes after levaror muscle lengthening of the right upper eyelid with incomplete eyelid closure due to hypotonia of the left lower eyelid and left mid face.

DISCUSSION

Paralytic lagophthalmos has been challenging in the continuous effort to avoid the complications of such problem. Paul Tessier introduced his technique of (LPS) lengthening in 1969. Other techniques: such as the gold weight technique, were introduced by other authors as well.

The idea of this study was to reassess the reproducibility and predictability of Paul Tessier's technique and to report the degree of easiness when carrying out the technique. Also we compared our results with the results produced by the original author as well as the results of the other techniques used to treat the same problem as reported in literature. This study found Paul Tessier's technique of (LPS) muscle lengthening quite reproducible with ease and was rewarding as well.

After one operating session, full correction of the palpebral fissure closure was achieved during standing and lying down position in most of the patients, and this was found in keeping with the results and findings reported by Guillou-Jamard et al.[4] The learning curve of (LPS) muscle lengthening using temporalis aponeurosis was found short enough, given the rules and mathematical formula of the proper technique are followed.

In some patients (2 out of 15 patients) residual lagophthalmos was found because of hypotonia of the lower eyelid. The results of this technique were found quite favorably comparable with the results of the original author Tessier et al.[6] and of other techniques by Terzis et al.[7] used in treatment of lagophthalmos due to facial palsy, such as gold weight technique where the correction of lagophthalmos was found during standing, but not during lying down due to the effect of gravity. [9]

Ophthalmic manifestations were resolved within few weeks after the full correction in most of the patients. The course of recovery after using this technique showed no side effects, while in the gold weight other side effects were found such as extrusion, infection, visibility, distortion of the upper eyelid,

occasional astigmatism and the cost of the gold plate).[3,5,8]

The aesthetic appearance of the upper eyelid and patients' satisfaction after Paul Tessier's technique of (LPS) muscle lengthening was found far higher than in patients after using gold weight technique reported in the literature.[10]

Guillou–Jamard et al.[4] published a study of 29 patients who were treated with (LPS) muscle lengthening by aponeurosis interposition as Paul Tessier's description. Without any big troubles, they all obtained nearly complete palpebral occlusion, a significant improvement in their visual comfort and aesthetic appearance. In addition, Pirrelo et al.[12] published 12-case research employing the same procedure (Paul Tessier's technique) in which 9/12 patients achieved total eyelid closure and all cases experienced complete relief of their subjective symptoms.[11]

In our series, we observed that the functional results were better than those previously reported with gold weights, with a lower morbidity rate, better aesthetic results, and a procedure that is more patho-physiologically relevant than gold plate insertion. Paul Tessier's approach, which does not rely on gravity, provides superior nighttime corneal protection than upper lid loads. Furthermore, the surgical technique is easy and inexpensive.

CONCLUSION

The levator palpebrae superioris muscle can be lengthened to treat paralytic lagophthalmos using aponeurosis interposition, with favourable results in terms of both function and aesthetics. It is straightforward, reproduced easily and dependable operation. It was shown to be superior to other approaches described in the literature, such as the gold weight technique, which had more side effects and produced a less practical and aesthetic result.

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