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Comparison of the Surgical Outcomes in Minimally Invasive Levator Advancement with Opening of Orbital Septum and Sparing of Orbital Septum in Involutional Ptosis

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ABSTRACT

Objective: To compare surgical outcomes in minimally invasive levator advancement with opening of orbital septum and sparing of orbital septum in involutional ptosis.

Study Design: Quasi-experimental Study.

Place and Duration of Study: Department of Ophthalmology, PNS Shifa Hospital, Karachi Pakistan, from Mar 2022 to Mar 2024.

Methodology: Hundred eyes were divided into 02 groups of 50 each with Group-A undergoing minimally invasive levator advancement with sparing of orbital septum and Group-B undergoing same procedure with opening of orbital septum. Skin incision length was kept at 10mm and after exposing tarsus, only a single central suture was employed to reattach levator aponeurosis with tarsus. Surgical time for every case was recorded. Successful outcome was interpreted if margin reflex distance was within 2 to 4mm in bilateral ptosis or within 1mm of contralateral lid in unilateral ptosis. Chi-square test was selected to interpret success rate and Student's t-test was used to compare surgical time of two groups.

Results: Median(IQR) postoperative marginal reflex distance after minimally invasive levator advancement in Group-A with sparing of orbital septum was 3.5(0.6) mm and in Group-B with opening of orbital septum was 3.5(0.4)mm. Comparison of success rate between two groups showed statistically insignificant difference (p=0.603) Surgical span time was significantly briefer in Group-A with sparing of septum versus Group-B with opening of septum (p<0.001).

Conclusion: Minimally invasive levator advancement is an effective procedure and orbital septum opening does not improve success rate while sparing septum achieves significant reduction in surgical time.

Keywords: Aponeurotic, Eyelid Intervention, Eyelid Surgery, Minimally Invasive Surgical Procedure, Orbital, Ptosis, Septum Surgery.

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INTRODUCTION

Ptosis of the eyelid is caused either by malfunction of the levator palpebra superioris (LPS) muscle which is the key hoist of the upper lid and is a striated muscle or Muller's muscle which acts together with LPS.[1] LPS gets its nerve supply from the superior branch of oculomotor nerve and controls eyelid opening. Muller's is a smooth muscle therefore it is activated by sympathetic fibers, and its role is to provide resting tone to the eyelid with 2-3mm of donation in eyelid uplift.[2] LPS emanates from sphenoid's lesser wing and widens to an aponeurosis that inserts on upper half of tarsus and skin. Muller's muscle emerges from undersurface of LPS and lodges on superior tarsal border.[3]

Causative factors for ptosis might be congenital, myopathic, neuropathic and involutional1 and among them it is the disinsertion or dehiscence of aponeurosis that accounts for the most common type encountered by oculoplastic surgeons.[4] In 90% of older patients, aponeurotic type of ptosis is the most common type seen.[5]

Scores of options exist for the surgical correction of ptosis depending on its gravity and levator function.[6] For correction of aponeurotic ptosis, advancement of levator through the skin and muller-muscle conjunctival resection through the conjunctiva are frequently employed.[5,7]

The anterior approach is advantageous because it allows for skin excision, intraoperative modification, unhindered visualization of anatomical structures, safeguarding of conjunctiva and redo surgeries.[5,8]

Septum orbitales often referred to as the central lamella of eyelid is a strong inelastic tissue that attaches to LPS 8-10mm above the superior tarsal border after originating at the superior orbital roof several millimeters behind the orbital rim. The orbital fat lies behind the septum.[2,9]

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External ptosis repair that is performed through conventional techniques incorporates a longer skin incision however a small incision technique exists in which 8-10 mm incision is given.[8] Review of literature has mentioned this minimally invasive technique but the role of orbital septum in not clearly defined therefore our study's purpose was to use this minimally invasive levator aponeurosis advancement (MILA) strategy in patients with aponeurotic ptosis and compare the results by either sparing or opening the orbital septum before performing levator advancement and resuturing of aponeurosis to the tarsal plate.

METHODOLOGY

This quasi experimental study was performed at the Eye Department of PNS Shifa hospital Karachi from March 2022 to March 2024. The project was approved by the ethical review committee of the hospital (Ltr No. ERC-2022/EYE/ dated 07/03/22). Participants of the study were selected from those patients who visited the outdoor unit of the department by applying convenience sampling method.

Inclusion Criteria: Standards for including the patients in study were unilateral or bilateral involutional ptosis, levator function not less than 10mm and minimal dermatochalasis.

Exclusion Criteria: Candidates who had undergone previous upper eyelid surgery or required upper lid blepharoplasty were excluded from the study.

Patients fulfilling the inclusion criteria were divided into two groups, Group-A(Orbital septum spared) and Group-B(orbital septum opened). Sample size of 50 (n=50) eyes in each group was computed to find out a significant variation in the success rate among the two groups with 80% power and a two sided α of 0.05 using success rate of 75 % (P1= success rate without opening orbital septum) 10 and 95% (P2= anticipated success rate with opening of orbital septum) from prior published data that have employed comparable surgical techniques as ours and with the help of WHO calculator for sample size.

Preoperatively the levator function, margin-reflex distance, upper lid skin laxity and lid photographs were recorded. All surgeries were performed by the same surgeon.1ml of 1.0 % Lignocaine with 1:100,000 Adrenaline was injected beneath the marked lid skin crease. The skin incision was made with a monopolar cautery for a length of 10mm.Using a sharp tipped scissor, the underlying orbicularis muscle was incised by aiming towards the center of the tarsal plate. The orbicularis fibers were bluntly separated until the semitransparent levator aponeurosis insertion on the tarsal plate was visible which was also dissected to expose the white bare tarsal plate. The pretarsal orbicularis was separated from the tarsus along the entire length of skin incision. The group of patients that was selected for opening of the orbital septum (Group-B) had their septum incised for a length of 10mm and exposing the preaponeurotic fat. In the other group (Group-A) the orbital septum was not opened. The next remaining steps in both groups were identical wherein the underlying levator aponeurosis was separated from the tarsus with sharp tip scissors and isolated from the underlying Muller's muscle. Twin armed 6-0 Vicryl suture was advanced partial thickness in and out the tarsal plate and then across the aponeurosis at a predetermined point and a temporary knot was tied. The patient was seated, and lid location and curve were assessed. Temporary knot was converted to permanent knot if lid height seemed satisfactory otherwise the suture was pulled out from aponeurosis and readjusted, rechecked and finally tied. The skin was secured with interrupted sutures. The surgical time was recorded for each surgery. Follow up was scheduled at 1st post op day then at 01 week and finally at 01 month postop. The surgical outcomes were assessed at 01 month postop and included measurement of margin-reflex distance (MRD) and eyelid contour. A successful outcome was interpreted if the MRD was within 2 to 4mm in bilateral ptosis or within 1mm of the contralateral lid in unilateral ptosis having placed the patient's stare in primary gaze. The eyelid contour was judged as satisfactory or unsatisfactory based on postoperative photographs. Unsatisfactory contour was further subdivided into peaked contour, flat contour, medially lower lid and laterally lower lid. Reoperation was advised if the MRD was less than 2mm or inter eyelid asymmetry was greater than 1.0mm and concurrently the patient was not satisfied with lid height.

Statistical analysis was performed by applying Statistical Package for Social Sciences (SPSS) 23.0. Descriptive statistics, mean and standard deviation were computed for age, margin-reflex distance and surgical time. Normal distribution of data for age, margin-reflex distance and surgical time was assessed using Kolmogorov Smirnov normality test. Data of age and surgical time showed normal distribution while margin reflex distance data was not distributed normally. Gender distribution was described as

frequency and percentages. Results of surgery were described in terms of frequency and percentages. Chi-square test was selected to compare the success rate between the two groups. Postoperative margin reflex distance was calculated as Median (IQR) for both groups. Student's samples t-test was utilized to compare the surgical time of the two groups. A *p*-value ≤0.05 was considered statistically significant.

RESULTS

A total of 100 eyes were operated upon with 50 eyes having undergone minimally invasive levator advancement with sparing of orbital septum (Group-A) and 50 eyes undergoing same procedure with opening of the orbital septum (Group-B). Out of 100, 53(53%) patients were males and 47(47%) were females. Mean age of patients in Group-A was 66.36±4.22 years and in Group-B it was 65.54±3.54 years.

Postoperative marginal reflex distance in Group-A was 3.5(0.6) mm and in Group-B 3.5(0.4) mm. Comparison of the success rate of minimally invasive levator advancement surgery between the two groups showed a statistically insignificant difference and therefore the outcomes of both techniques is comparable (Table-I).

Table-I: Comparison of the Success Rate of Minimally Invasive Levator Advancement with Sparing of Orbital Septum (Group-A) and Opening of Orbital Septum (Group-B) (n=100)

	Group-A (n=50)	Group-B (n=50)	*p*-value
Result	**Frequency (%)**	**Frequency (%)**	
Successful	40(80)	42(84)	0.603
Failed	10(20)	8(16)	

The time span of surgery was significantly shorter in MILA with sparing of the orbital septum versus MILA with opening of the orbital septum (Table-II).

Table-II: Comparison of the Surgical time between Groups (n=100)

	Group-A (n=50)	Group-B (n=50)	*p*-value
Mean Surgical time (mins)	35.3±0.77	45.48±0.74	<0.001

Amid the total 18 out of 100 (18%) cases without successful outcome, 11(61%) patients opted for reoperation and the remaining 07(39%) did not consent for redo surgery. Complications of the ptosis surgery recorded in both groups were peaked contour in 3 out 100 cases (3%) and in Group-A only 02 out of 50 eyes (4%) developed lagophthalmos.

DISCUSSION

The finding of our study shows that Minimally invasive levator advancement is an effective procedure and orbital septum opening does not improve success rate while sparing septum achieves significant reduction in surgical time. Small incision technique of ptosis repair was first introduced in 1999 by Lucarelli and Lemke. Lucarelli and lemke reported successful repair of ptosis with this technique in those patients who manifested droopy eyelids in absence of dermatochalasis. They described their technique which incorporated exposing the tarsus and tying only one fixation suture from levator aponeurosis to the tarsus.[11] The length of skin incision in this technique can vary from 8 to 10 mm. However, the value of this technique is not hidden in its skin crease length but in sparing the anatomy as the length can be enlarged if a blepharoplasty is required. Therefore, in minimally invasive levator advancement (MILA), the surgery is solely through the skin, orbicularis and levator aponeurosis that is overhanging the tarsal plate producing little disruption of tissue and achieving favorable results.[12] Baroody *et al.,* performed MILA through a 8-13mm incision and reported that a small skin incision is safe, accurate, efficient and shortens the recovery time of surgery.[13] We performed MILA through a 10mm incision in all our cases and did not record any wound related complications.

The presence of coexisting dermatochalasis in ptosis is not a drawback for performing MILA. The only difference lies in the technique of managing dermatochalasis which is managed like the conventional blepharoplasty technique of excising redundant skin subsequently orbicularis muscle is excised and orbital septum is only incised for 10mm and a single stitch is moved across levator and tarsus to complete MILA procedure.[11] Jung *et al.,* published a success rate of 84.6% in patients with coexisting dermatochalasis and ptosis.[11] Waqar *et al.,* have suggested that it is more elegant to correct concomitant dermatochalasis and ptosis with the traditional levator aponeurosis advancement(LAA) technique.[14] Similarly in our study dermatochalasis was not a bar for MILA but severe dermatochalasis cases were excluded from the study and we preferred the traditional approach for such cases.

How much minimal levator function should a patient have before he can be considered for MILA is a question that was very well answered by Gire et al. who suggested that MILA procedure is inefficient in

advanced ptosis along with minimal levator function but works very well with mild to moderate ptosis with good levator function.[15] In another study a good levator function of at least 8mm was considered to produce adequate results since poor levator function warranted more advancement and upward dissection.[11] We choose a minimal levator function of 10mm regardless of the severity of ptosis.

Opening the orbital septum and isolating the levator aponeurosis completely from Muller muscle is a key aspect reported by several authors.[16,17] The incision made to the orbital septum in MILA is small and usually around 10mm in length.[11] However in the event of peaked eyelid or unsatisfactory eyelid contour after MILA, Jung *et al.,* reoperated his cases and reopened the orbital septum up to the traditional length for applying three fixation sutures and in some cases slightly widened the septum incision laterally and medially to achieve satisfactory eyelid contour.[11] Noting the site of fusion of orbital septum with levator aponeurosis is a crucial step during ptosis surgery because septum plays a salient role in providing a cosmetically acceptable lid crease.[18] McDonald has described his technique of handling orbital septum in MILA where he bluntly dissects the orbital septum away from the levator aponeurosis instead of making an incision in the septum.[12] On the other hand Kartal *et al.,* did not divide but rather conserved the boundaries of orbital septum during MILA and recorded results equal to standard levator advancement procedure.[19] The orbital septum in our research was handled both ways by dividing it in one group and preserving it other group while executing MILA for both groups.

The surgical procedure of MILA is quicker than the traditional approach for aponeurosis surgery.[14] In a comparative study by Gire *et al.,* between MILA and traditional aponeurotic surgical procedures in involutional ptosis it was concluded that MILA is much quicker to perform.[15] McDonald tracked down that MILA is feasible within 03 minutes if circumstances are favorable in his own cases[12] while Freuh recorded a mean surgical time of 25±13 mins in MILA and 55±16 mins in classic levator advancement.[10] In our study the mean surgical time without opening the orbital septum was 35.3±0.77 and 45.48±0.74 mins with opening of the orbital septum which is in agreement with previous published data however, we recorded a significantly shorter duration in cases where orbital septum was not opened.

Every surgical procedure has its inherent complications. Common early postoperative complications of ptosis surgery are symmetric eyelid height, contour,[20] under correction and over-correction.[21] Over and under correction may resolve overtime.[21] Late complications include recurrent ptosis, lagophthalmos, persistent over and under-correction.[22] Under correction is the most common complication of MILA.[12]

Two comparative studies concluded that the rate of redo surgery for recurrent ptosis after Minimally invasive levator aponeurosis advancement is not significantly different from the traditional aponeurotic surgery in involutional ptosis.[10,15] Jung *et al.,* recorded a 15.4% recurrence ptosis rate in MILA with orbital septum incision.[11] In a highly selective group of patients the rate of redo surgery was as low as 9.3% but the author concluded that MILA is applicable only to a restricted group of patients.[23] In our study orbital septum incision or sparing did not affect the outcome and we recorded a statistically insignificant difference in the success rate of surgery with 84% and 80% success rates with opening and sparing of the orbital septum respectively. To date there is no published data that have conducted a comparative study for the role of orbital septum in MILA and its effect on the outcome.

Overall, in all the patients combined the reoperation rate in our study was 18% whereas in traditional levator aponeurosis advancement surgery the repeat rate for recurrent ptosis varies from 10% to 20%.[24] Therefore the frequency for redo surgery in MILA and traditional repair is similar.

To conclude MILA is a beneficial procedure for acquired ptosis in cases with good levator function and orbital septum opening does not improve the success rate of surgery and on the contrary sparing the orbital septum achieves a significant reduction in surgical time.

LIMITATION OF STUDY

We did not analyze the severity of ptosis and its impact on the rate of reoperation and suggest further studies need to be conducted that can accurately predict the role of preoperative marginal reflex distance and recurrent ptosis in MILA.

CONCLUSION

Minimally invasive levator advancement is an effective procedure and orbital septum opening does not improve success rate while sparing septum achieves significant reduction in surgical time.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

FAK & SPN: Data acquisition, data analysis, critical review, approval of the final version to be published.

MIS & UD: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

OF & OY: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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