

Treatment of Blepharoptosis in pediatric patients using modified frontalis sling technique with lid crease creation



Shahid Hussain Shah¹, Asif Mashood Qazi²
Muhammad Moez-ud-Din³, Israr Ahmed⁴, Shoaib Ahmed⁵
^{1,3,4,5}Isra Postgraduate institute of Ophthalmology, Al-Ibrahim Eye
Hospital, Karachi. ²Al-Tibri Medical College

ABSTRACT

Purpose: To observe the aesthetic and visual outcomes of a modified frontalis sling technique with lid crease creation in pediatric patients of upper lid drooping associated with weak Levator muscle.

Study Design: Quasi experimental study.

Place and Duration of Study: Al-Ibrahim Eye Hospital from January 2024 to June 2024.

Methods: This study included pediatric patients (either gender) with congenital ptosis associated with weak Levator muscle. Preoperative eye examination and Ptosis examination including lid crease and fissure height, Levator muscle function, MRD-1, MRD-2, and Bell's reflex were performed. All the registered patients underwent modified frontalis sling procedure with lid crease creation using silicon tube. Lid fissure and lid crease height and MRD-1 measurements were performed at 1st, 8th and 24th weeks after surgery. Pictures were captured both pre and postoperatively for comparison. Any side effects occurring during or after the procedure were also noted.

Results: Six months after the procedure, 86% of patients showed desired results, with symmetrical eyelid appearance and negligible under correction (<1mm). Mean lid fissure height, lid crease height and MRD-1 were significantly increased (3.77 ± 1.76 mm, 3.20 ± 0.51 mm and 3.23 ± 1.65 mm respectively) after 6 months. Visual acuity was also improved. Minor side effects were observed only in a few cases. Under correction of around 1mm occurred in 6 (13.95%) patients.

Conclusion: Modified frontalis sling technique with lid crease creation using silicon tube has shown superior aesthetic and visual results along with less side effects in paediatric patients of upper lid Ptosis from birth.

Key Words: Modified Frontalis sling technique, Lid crease creation, Blepharoptosis, silicon tube, Pediatric patients.

How to Cite this Article: Shah SH, Qazi AM, Moez-ud-Din M, Ahmed I, Ahmed S. Treatment of Blepharoptosis in pediatric patients using modified frontalis sling technique with lid crease creation. 2025;41(1):29-34.

Doi: 10.36351/pjo.v41i1.1910

Correspondence: Shahid Hussain Shah
Isra Postgraduate institute of Ophthalmology
Al-Ibrahim Eye Hospital, Karachi
Email: drshahid.rashdi@gmail.com

Received: August 01, 2024
Revised: December 11, 2024
Accepted: December 27, 2024

INTRODUCTION

Blepharoptosis or Ptosis is a frequently occurring medical disorder characterized by sagging of the upper

eyelid. This can be present at birth due to some congenital disorder or develop later in life due to various causes.¹ Ptosis can occur in one or both eyes and manifest with varying degrees of magnitude ranging from mild to severe. It can result from various causes including trauma, aponeurotic disorders, neurogenic, or myogenic factors.²

Typically, Ptosis occurs as an isolated disease, but it can also be allied with other systemic illnesses. Patients with Ptosis often have a characteristic sleepy appearance and may experience various ocular symptoms, such as blurred vision and excessive tear

formation. Additionally, sustained contraction of the scalp muscles can lead to headache and ocular discomfort due to compensatory mechanisms to elevate the upper eyelid. Amblyopia, which results in permanently weak eyesight, may occur if congenital ptosis is not addressed.² Early intervention is crucial, as neglecting treatment can result in a range of consequences, including emotional distress, such as appearance-related anxiety and depression, as well as compromise in functional and visual outcomes, particularly defects in the superior visual field, which can hinder daily activities and quality of life.^{3,4}

Correcting Ptosis poses a challenging task for oculoplastic surgeons as they must skillfully balance aesthetics with functionality, delivering exceptional cosmetic results while also improving visual functions. Symmetrical upper lid crease, lid fissure, and lid outline yields better aesthetics effects.^{5,6,7} Eyelid muscle condition and key ophthalmologic aspects must be carefully considered when selecting a surgical procedure to correct the aberrant eyelid position.^{6,7}

Traditionally, the preferred treatment for correcting Ptosis due to weak Levator muscle function (<4 mm) has been the frontalis muscle sling procedure, which utilizes autogenous or exogenous materials.^{8,9} Although new materials have been introduced, the fundamental technique of the frontalis sling procedure has remained largely unchanged since its initial development. Recently, there has been increasing trend of using silicon tube in eye lid surgery due to its ease of access, cost effectiveness, and superior aesthetic outcomes.¹⁰⁻¹² Despite its widespread use in Ptosis correction, there is a lack of scientifically validated studies documenting the outcomes of using silicon tube in this context. The present study aims to address the aesthetic and visual outcomes of a modified frontalis sling method with lid crease creation using silicon tubes in pediatric patients of upper lid drooping allied with weak Levator muscle.

METHODS

This interventional research was conducted in the Al-Ibrahim Eye Hospital for 6 months, from January 2024 to June 2024, following approval from the Institutional Review Board (IRB NO:REC/IPIO/2024/087).

pediatric patients of either sex with congenital Ptosis (one or both eyes involved) and weak Levator muscle (<4mm), requiring oculoplastic surgery, were enrolled in this study. Patients with past medical

record of eyelid injury, surgery, weak Bell's reflex (< 2+), dryness of eyes, and systemic illnesses were excluded. Sample size was determined using online sample size calculation tool (CI 95%, margin of error 5, population percentage 50 and population count 48). The study sample consisted of 43 patients (49 eyelids) affected with upper lid drooping.

Preoperative eye examination specifically visual acuity of all the registered patients was carried out. Eyelid assessment comprised of measuring lid crease height, lid fissure height, Levator muscle function, MRD-1, MRD-2 and Bell's reflex. All the registered patients underwent modified frontalis sling procedure with crease creation using silicon tube.

MRD-1, eye lid crease and fissure height measurements were repeated at 1st, 8th and 24th week after surgery. Pictures were captured both pre and postoperatively for future comparison and follow-up. Any side effects or complications occurring during or after the procedure were also noted down.

A 4-0 silk suture was inserted in the center of the upper eyelid. The upper lid was incised with two horizontal incisions measuring 2mm each, 6 mm superior to lash line, cutting to the tarsus, after a lid plate had been inserted to guard the eyeball. To access the frontal periosteum, three incisions (2mm each) were positioned superior to the upper border of eyebrow. The medial and lateral incisions were at the eyebrows upper border, while the central incision was located 5mm higher. The distance among all the incisions was equal to each other.

Silicon tube was introduced into the upper eye lid in the form of pentagon using a wright needle. The needle was introduced through the medial incision without incorporating periosteum. It was introduced downward and backward between the orbicularis and Levator muscle. It proceeded anterior to tarsal plate heading towards the medial incision, and eventually came out through the incision. The needle was withdrawn, pulling the silicon tube through the medial eyelid incision and exiting through the medial brow incision. At each end of eyelid incision, the silicon tube was sutured to orbicularis muscle by a 6-0 vicryl suture. Both strands of silicon tube were sutured and concealed under the frontalis muscle. The middle brow incision was sutured with 6-0 prolene suture. After the operation, tobramycin and dexamethasone eye ointments were applied topically to the skin and stitched with tarsorrhaphy suture using silk (6-0)

Table 1: Visual and aesthetic outcomes after modified frontalis sling technique.

Variable	Pre-operative findings	Post-operative findings			P-Value
		1 week	8 weeks	24 weeks	
Lid crease height (mm)	0.46±0.27	1.86±0.45	2.98±0.73	3.20±0.51	0.03
Lid fissure height (mm)	0.89±0.43	2.77±0.57	3.61±1.34	3.77±1.76	0.04
MRD-1 (mm)	0.23±1.22	2.61±0.23	2.79±0.30	3.23±1.65	0.01
Lid and crease symmetry	Not symmetrical	Symmetrical	Symmetrical	Symmetrical	-
Lid contour	Not Symmetrical	Symmetrical	Symmetrical	Symmetrical	-

suture. A gentle dressing was applied to protect the cornea and kept in place for 1 day. Frost stitches were removed if there were no signs of complication in cornea, otherwise its removal was delayed. Patients were scheduled for follow-up appointments at 1, 8 and 24 weeks post procedure. Images were captured at every visit to document progress and for comparative analysis.

All collected data, including baseline information and preoperative and postoperative findings, were compiled in MS Excel and analyzed using SPSS version 26. Descriptive data were presented as mean and standard deviation for continuous variables, and frequency and percentages for categorical variables. Repeated-measures ANOVA was applied to compare means across three postoperative time points, followed by paired t-tests for comparisons between each pair of time points. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 43 patients (49 eyelids) including 23 (53.48%) male subjects and 20 (46.51%) females with mean age of 10±1.4 were subjected to modified sling procedure. Each patient had a congenital condition of ptosis, accompanied by weak Levator muscle. Ptosis affected one eye in 37 patients (86%) and both eyes in 6 patients (13.95%). Mean Levator function was 0-3mm (mean 1.2±0.3). Six months after the procedure, 86% patients showed desired results, with symmetrical eyelid appearance and negligible under correction (<1mm).

The lid crease showed a significant increase in height, with a mean augmentation of 3.20±0.51mm. A mean increase of 3.77±1.76mm was observed in lid fissure

height. There was considerable increase in MRD1 as well, with a mean increase of 3.23±1.65mm, 6 months after surgery. Six eyelids (13.95%) showed under

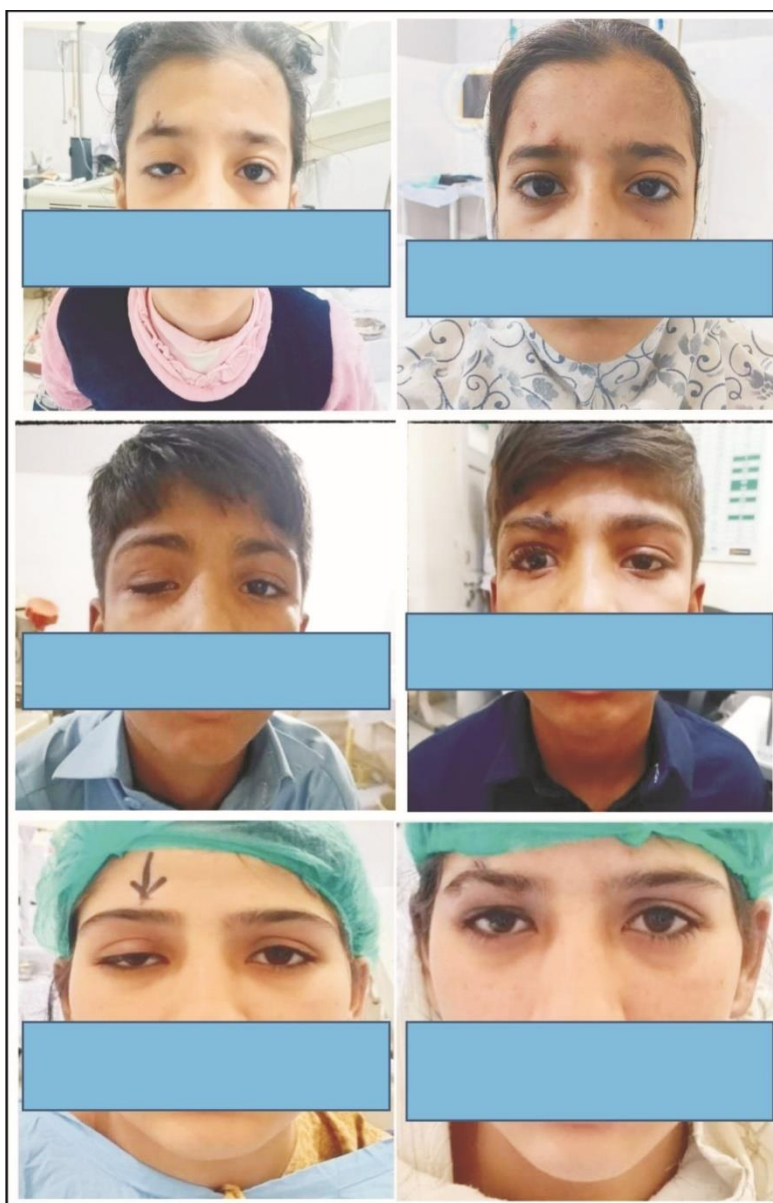


Figure 1: Pre and post operative pictures (after 6 months) of three patients with congenital ptosis after modified frontalis sling technique with lid crease creation.

correction of around 1mm that is clinically non-significant (Table 1, Figure 1).

DISCUSSION

Conventional technique of Frontalis sling procedure often results in poor cosmetic outcomes and side effects often requiring reoperation.¹³ Current study presents the visual and aesthetic results of a modified frontalis sling method with lid crease creation in pediatric patients suffering from drooping of upper eyelids by birth accompanied with weak Levator muscle. It was observed that this modified technique resulted in much better cosmetic and visual outcomes compared to traditional technique. The frequency of side effects and complications was very less. The traditional technique involves making incisions in the eyelids 2 mm above the lashes. A Wright needle was used to introduce exogenous material under the frontalis muscle above the eyebrow and inside the upper lid, between the Levator and orbicularis muscles.^{1,2} This technique involved placing eye lid incisions 6mm above the eyelashes, at lid crease level. Positioning the skin incision higher results in a more natural looking eyelid crease following surgical intervention, hence minimizing the need for repeat procedures to create the crease. Higher location of sling material also reduces the risk of postoperative eye lid bulkiness.

Another researcher reported a different technique for creating a lid crease after a sling procedure. In this method, after creating the crease incision, the sling material was directly attached to the tarsus and then passed toward the eyebrow, similar to the traditional approach. Incision sutures were used postoperatively to fine-tune the lid crease height. However, this technique may cause significant tissue damage, potentially affecting the appearance of a normal lid. Additionally, the requirement for a second lid incision increases tissue damage and prolongs the healing process.¹⁴ A recent study reported a novel technique involving a single stab incision for silicone insertion. This approach demonstrated improved cosmetic and visual outcomes while minimizing the risk of side effects. The technique also reduced surgical time, facilitated a faster recovery process, and eliminated the need for multiple incisions.¹⁵

Another technique called “sling for sling” for the longstanding management of severe blepharoptosis using silicon material is also described. The author

reported that this newer technique displayed improved durability, resulting in lasting outcome with substantial reduction in recurrence rates.¹¹

Some surgeons perform a second procedure several months after the sling procedure to reconstruct the eyelid crease.^{1,2} Two-stage operations are more expensive and necessitate a longer hospital stay than single-stage procedure. Pediatric patients usually are operated under general anesthesia hence increasing the risk of exposure.

Furthermore, in this modified technique, the frontalis muscle was engaged while passing the needle between the eyelid and brow incisions, enhancing the strength of the frontalis muscle in lifting the upper eyelid. However, in this novel approach, the higher positioning of the sling material might reduce its elevating effect, particularly in pediatric patients, leading to under correction. The mild under correction of approximately 1 mm observed in children in our study could be attributed to the smaller size and height of their eyelids. Nevertheless, this level of under correction is cosmetically insignificant.

In our study, the silicone tube was inserted into the upper eyelid in a pentagonal configuration. This design provides greater lifting power from the frontalis muscle compared to the traditional single-triangle or rhomboid methods.¹⁶ This method minimizes tissue injury, reduces skin incisions and shorter surgical duration. Various other techniques of frontalis sling procedure are equally effective.¹⁷⁻²¹ Shome et al, reported that silicone sling surgery, when combined with eyelid crease creation and Levator excision, results in improved symmetry, enhanced aesthetic outcomes, and higher patient satisfaction. Similarly, Choi et al, highlighted that frontalis sling surgery using a silicone rod is a safe and effective treatment for ptosis in patients with third nerve palsy, with a minimal risk of corneal complications.¹²

In the modified technique, the medial and lateral brow incisions were positioned above the eyebrow in a midline orientation, differing from the traditional perpendicular approach. This variation aims to enhance upper lid elevation by reducing excess tissue bulk, resulting in a more natural-looking eye contour. Aletaha et al, reported similar outcomes using a modified frontalis technique in pediatric patients with congenital ptosis; however, they utilized Mersilene mesh as the incorporated material.²³

Our results reported very less side effects due to

use of silicon rod in ptosis surgery. However, Bansal et al also reported that although Silicone is safe to be used in eyelid surgeries; potential complications can arise.²⁴ Morris et al, reported that silicone rod frontalis surgery has shown modest efficacy, with minimal complications, smooth extraction and adjustability in children suffering from belpharoptosis.²⁵

Our findings are based on a relatively small sample of pediatric patients, which may limit the generalizability of the results. The follow-up period of six months may not be sufficient to assess long-term stability of outcomes or the potential for late complications. Approximately 13.95% of patients experienced mild under-correction (around 1 mm), which, while cosmetically insignificant, suggests variability in the surgical outcomes. The quasi-experimental design and absence of a control group make it difficult to attribute all observed outcomes solely to the modified technique. The results are specific to pediatric patients with congenital ptosis and weak Levator muscles, limiting applicability to other patient groups, such as adults or those with acquired ptosis. Addressing these limitations in future studies could enhance the reliability and applicability of the findings.

CONCLUSION

Modified frontalis sling technique, which incorporates lid crease creation using a silicon tube offers superior cosmetic results, satisfactory functional and visual outcomes and a reduced risk of complications and adverse effects. Additionally, this technique demonstrated a lower reoperation rate, making it a more desirable option. This study scientifically validates and justifies the use of silicon tubes in frontalis sling technique which is a cost effective and readily available material.

Funding: This study was not funded by any organization.

Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board (REC/IPIO/2024/087).

REFERENCES

1. **Bacharach J, Lee WW, Harrison AR, Freddo TF.** A review of acquired blepharoptosis: prevalence, diagnosis, and current treatment options. *Eye (Lond)*. 2021;**35(9)**:2468-2481. Doi: 10.1038/s41433-021-01547-5.
2. **Finsterer J.** Ptosis: causes, presentation, and management. *Aesthetic Plast Surg*. 2003;**27**:193-204.
3. **Richards HS, Jenkinson E, Rumsey N, White P, Garrett H, Herbert H, et al.** The psychological well-being and appearance concerns of patients presenting with ptosis. *Eye*. 2014;**28**:296-302. Doi:10.1038/eye.2013.264.
4. **Nichols KK, Malloy KA, Karpecki PM, Bacharach J, Douglas RS, Foster S, et al.** Topical Review: An Update of Diagnostic and Management Algorithms for Acquired Blepharoptosis. *Optom Vis Sci*. 2022;**99(3)**:230-240. Doi: 10.1097/OPX.0000000000001868.
5. **Lee JH, Kim YD.** Surgical treatment of unilateral severe simple congenital ptosis. *Taiwan J Ophthalmol*. 2018;**8(1)**:3-8. Doi: 10.4103/tjo.tjo_70_17.
6. **Hollander MHJ, Contini M, Pott JW, Vissink A, Schepers RH, Jansma J.** Functional outcomes of upper eyelid blepharoplasty: A systematic review. *J Plast Reconstr Aesthet Surg*. 2019;**72(2)**:294-309. Doi: 10.1016/j.bjps.2018.11.010.
7. **Hollander MHJ, Schortinghuis J, Vissink A, Jansma J, Schepers RH.** Aesthetic outcomes of upper eyelid blepharoplasty: a systematic review. *Int J Oral Maxillofac Surg*. 2020;**49(6)**:750-764. Doi: 10.1016/j.ijom.2019.10.014.
8. **Kratky V.** Treatment of congenital ptosis. *Annals of Eye Science*. 2020 Dec 15;**5**:37.
9. **Allard FD, Durairaj VD.** Current techniques in surgical correction of congenital ptosis. *Middle East Afr J Ophthalmol*. 2010;**17(2)**:129-133. Doi: 10.4103/0974-9233.63073.
10. **Ali Z, Kazmi HS, Bin Saleem MK, Shah AA.** Silicon tube frontalis suspension in simple congenital blepharoptosis. *J Ayub Med Coll Abbottabad*. 2011;**23(4)**:30-33. PMID: 23472406.
11. **Kotb AN, Soliman NM, Raza A, Nour NA, Mattout HK.** Sling for the sling: a new technique for long-term correction of severe congenital ptosis. *BMC Ophthalmol*. 2024;**24(1)**:112. Doi: 10.1186/s12886-024-03371-3.
12. **Choi YM, Kim N.** Frontalis Sling Using a Silicone Rod for Ptosis in Third Nerve Palsy: Cosmesis versus Safety. *Korean J Ophthalmol*. 2022;**36(2)**:159-167. Doi: 10.3341/kjo.2021.0138.

13. **Chung HW, Seah LL.** Cosmetic and functional outcomes of frontalis suspension surgery using autologous fascia lata or silicone rods in pediatric congenital ptosis. *Clin Ophthalmol.* 2016;**10**:1779-1783. Doi: 10.2147/OPHT.S113814.
14. **Yagci A, Egrilmez S.** Comparison of cosmetic results in frontalis sling operations: the eyelid crease incision versus the supra lash stab incision. *J Pediatr Ophthalmol Strabismus.* 2003;**40**(4):213-216. Doi: 10.3928/0191-3913-20030701-08.
15. **Agarwal A.** Surgeons explain new guided sling technique to treat ptosis. *Ocular Surgery News.* 2008;**26**(17). Available at: <https://www.healio.com/news/ophthalmology/20120331/surgeons-explain-new-guided-sling-technique-to-treat-ptosis>
16. **Clauser L, Tieghi R, Galiè M.** Palpebral ptosis: clinical classification, differential diagnosis, and surgical guidelines: an overview. *J Craniofac Surg.* 2006;**17**(2):246-254. Doi: 10.1097/00001665-200603000-00008.
17. **Wasserman BN, Sprunger DT, Helveston EM.** Comparison of materials used in frontalis suspension. *Arch Ophthalmol.* 2001;**119**(5):687-691. Doi: 10.1001/archoph.119.5.687.
18. **Clauser L, Tieghi R, Galiè M.** Palpebral ptosis: clinical classification, differential diagnosis, and surgical guidelines: an overview. *J Craniofac Surg.* 2006;**17**(2):246-254. Doi: 10.1097/00001665-200603000-00008.
19. **Leibovitch I, Leibovitch L, Dray JP.** Long-term results of frontalis suspension using autogenous fascia lata for congenital ptosis in children under 3 years of age. *Am J Ophthalmol.* 2003;**136**(5):866-871. Doi: 10.1016/s0002-9394(03)00466-5.
20. **Philandrianos C, Galinier P, Salazard B, Bardot J, Magalon G.** Congenital ptosis: Long-term outcome of frontalis suspension using autogenous temporal fascia or fascia lata in children. *J Plast Reconstr Aesthet Surg.* 2010;**63**(5):782-786. Doi: 10.1016/j.bjps.2009.01.083.
21. **Ben Simon GJ, Macedo AA, Schwarcz RM, Wang DY, McCann JD, Goldberg RA.** Frontalis suspension for upper eyelid ptosis: evaluation of different surgical designs and suture material. *Am J Ophthalmol.* 2005;**140**(5):877-885. Doi: 10.1016/j.ajo.2005.05.031.
22. **Shome D, Mittal ST, Kapoor R.** Effect of Eyelid Crease Formation on Aesthetic Outcomes post Frontalis Suspension for Unilateral Ptosis. *Plast Reconstr Surg Glob Open.* 2019;**7**(1):e2039. Doi: 10.1097/GOX.0000000000002039.
23. **Aletaha M, Salour H, Bagheri A, Raffati N, Masoudi A.** Modified frontalis sling procedure with lid crease formation. *J Ophthalmic Vis Res.* 2013;**8**(2):134-138. PMID: 23943688; PMCID: PMC3740465.
24. **Bansal RK, Sharma S.** Results and complications of silicone frontalis sling surgery for ptosis. *J Pediatr Ophthalmol Strabismus.* 2015;**52**(2):93-97. Doi: 10.3928/01913913-20150313-11.
25. **Morris CL, Buckley EG, Enyedi LB, Stinnett S, Freedman SE.** Safety and efficacy of silicone rod frontalis suspension surgery for childhood ptosis repair. *J Pediatr Ophthalmol Strabismus.* 2008;**45**(5):280-288; quiz 289-90. Doi: 10.3928/01913913-20080901-11.

Authors Designation and Contribution

Shahid Hussain Shah; *Senior Registrar*: Concepts, Design, Literature search, Manuscript review.

Asif Mashood Qazi; *Associate Professor*: Data acquisition, Manuscript editing.

Muhammad Moez-ud-Din; *Consultant Ophthalmologist*: Manuscript preparation.

Israr Ahmed; *Professor*: Data analysis, Manuscript review.

Shoaib Ahmed; *Senior Registrar*: Statistical analysis Manuscript review.

