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Original Article

Analysis of Corneal Topographic Changes after Upper Lid Surgery in Congenital and Acquired Ptosis

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ABSTRACT

Objective: To assess the corneal topographic and refractive changes after ptosis surgery.
Study Design: Prospective longitudinal study.
Place and Duration of Study: Armed Forces Institute of Ophthalmology, Rawalpindi Pakistan, from Jan 2020 to Jul 2021.
Methodology: A total of 90 individuals were selected by non-probability convenience sampling. Patients with diagnosed Ptosis and planned for surgery were followed up for six months post-surgery. Corneal topography, visual acuity, and physical assessment for Ptosis were done pre and post-surgery and compared for differences.
Result: There were more cases of acquired Ptosis than congenital in our sample (p=<0.001). The patients had more poor levator function pre-operatively (p=0.291), which improved to fair post-operatively (p=<0.0001). Post-operatively, a significant decrease in the SimK and Cylinder power was observed in the sample. The visual acuity improved significantly, and the MRD also improved. With no significant change in CCT post-operatively.
Conclusion: Our study showed that post-surgery SimK, visual acuity, MRD, and cylindrical power improved. However, the CCT did not show significant alterations.

Keywords: Acquired ptosis, Congenital ptosis, Corneal topographic changes, Upper lid surgery.

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INTRODUCTION

Blepharoptosis is a condition of the eye where the upper lid droops or gets displaced, causing a visual axis blockage. Any pathology or lesion causing disturbance of the muscles or nerves leads to Ptosis.[1] Ptosis may be congenital or acquired, progressive or non-progressive, acute or chronic, unilateral or bilateral.[2] The frequency and incidence of ptosis changes from region to region. An overall four to thirteen per cent incidence has been documented.[3] In Korea and other Asian countries, it is reported to be prevalent in twelve to thirteen per cent of people.[4,5] A study from Pakistan discovered the frequency of congenital Ptosis to be around 8.8%.[6]

A study comprising two hundred individuals undergoing blepharoptosis correction was conducted. It was reported that post-surgery patients suffered keratitis due to incomplete closure of the lids post-surgery, swelling of conjunctiva and cornea leading to ulcer formation.[7] Among other complications, the literature suggests a change in the refractive status in individuals of Pakistan. The predominant refractive error enlisted was astigmatism. Post-surgery, the visual axis improves; however, astigmatism often leads to amblyopia and low vision in younger patients.[7] The corneal curvature changes need to be more adequately studied. The literature has also discussed refractive changes such as astigmatism myopic and hyperopic shifts.[8,9] Contrary to the myopic shift, one of the studies showed that a decrease in marginal reflex distance was linked with a hyperopic change and astigmatism of higher power post-operatively.[10]

As ptosis surgery is a frequent procedure and necessary to preserve vision, it is necessary to be aware of the possible refractive outcomes, which, if unaddressed, can influence the visual quality and may lead to amblyopia in children. Our study aimed to assess the corneal topographic and refractive changes after ptosis surgery.

METHODOLOGY

The cross-sectional study was conducted AT the Armed Forces Institute of Ophthalmology, Rawalpindi Pakistan, from January 2020 to August 2021, after approval from the Ethics Committee (Reference number= 204/ERC/AFIO). The sample size was calculated based on 13.5% prevalence of blepharoptosis.[11]

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Inclusion Criteria: All patients aged 5-70 years with a history of Ptosis were included. The degree or severity of Ptosis was not considered for inclusion.

Exclusion Criteria: Patients with eyelid diseases other than Ptosis, having previous surgery records pertinent to the eye and the patients with ptosis surgery history were excluded.

Information regarding the onset of the disease was sought. Visual acuity measurement using the LogMAR chart and cycloplegic refraction was done. Slit-lamp biomicroscopy and palpebral fissure height measurement with a scale, the upper eyelid margin reflex distance assessment, and levator function estimation with Berke's method were done. Corneal topography (using Galilei G6) was used before surgery and six weeks after ptosis surgery to evaluate the corneal topographic changes. Study variables, including simulated keratometry readings (Sim K), astigmatism and central corneal thickness (CCT), were noted from corneal topography. The levator function (poor, fair, good) using Berke's method and ptosis type (mild, moderate, severe were categorized.[11,12]

The pre-operative and post-operative data were evaluated statistically using the Statistical Package for Social Sciences (SPSS) version 23. The paired sample t-test was applied to compare the difference in the means of pre and post-operative groups. The Chi-square test was used to compare the frequencies of the variables. The *p*-value of less than or equal to 0.05 was considered significant.

RESULT

A total of 90 individuals planned for ptosis surgery were included in the study. A total of 40(44%) males were in the sample with acquired and congenital ptosis and 50(56%) females (p=0.295). The mean age in the sample was 40.88±20.92 (minimum=6 years, maximum=69 years). Pre-operatively, the moderate degree 44(49%) of Ptosis was predominant in our sample, followed by severe Ptosis. Post-operatively, around 103(57%) individuals were left with insignificantly evident Ptosis (Table-I). There were more cases of acquired Ptosis 61(68%) than congenital Ptosis 29(34%) in our sample. The patients pre-operatively had poor levator function) which improved to fair post-operatively (p<0.001) (Table-II).

Post-operatively, a significant decrease in the SimK and astigmatism was observed in the sample. The visual acuity and the MRD also improved significantly. However, the CCT did not significantly change (Table-III).

Table-I: Frequency of the degree of Ptosis in the Study Participants (n=90)

Study Groups	Degree of Ptosis				*p*-value
	No Ptosis (n%)	Mild (n%)	Moderate (n%)	Severe (n%)	
Preoperative	0(0%)	9(10%)	44(49%)	37(41%)	<0.001
Postoperative	64(71%)	20(22%)	6(7%)	0(0%)	

Table-II: Frequency of Degrees of Levator Function in the Study Participants (n=90)

Study Groups	Levator Function			*p*-value
	Poor (n%)	Fair (n%)	Good (n%)	
Preoperative	27(30%)	26(29%)	37(41%)	<0.001
Postoperative	0(0%)	53(59%)	37(41%)	

Table-III: Means of corneal topographic changes and Ptosis variables (n=90)

Variables	Pre-Operative (n=90)	Post-operative (6 months later) (n=90)	*p*-value
	Mean±SD	Mean±SD	
SimK (D)	42.1±1.55	41.75±1.21	0.04
Cylinder (D)	1.40±0.55	1.17±0.59	0.007
VA(LogMAR)	0.31±0.23	0.14±0.11	<0.001
CCT (µm)	544±31.0	539±29.71	0.283
MRD (mm)	2.78±0.79	4.80±0.75	<0.001

DISCUSSION

Our study aimed to assess the long-term alterations in visual parameters and corneal topography in individuals experiencing upper eyelid ptosis surgery. Our results revealed a significant improvement in the Sim K level, astigmatism, visual acuity, marginal reflex distance, and central corneal thickness post-surgery. These results were similar to a study comprising 30 individuals suffering from severe dermatochalasis. The patients were followed up at three, six and twelve months. A comparison of pre and post-operative corneal parameters was done. It was reported that the proportion of females presenting with Ptosis was more than the males. Visual acuity and corneal topographic measurements were determined. They reported that astigmatism showed a statistically substantial difference after surgery.[8] This is similar to our study results, showing an improvement or difference among corneal topography parameters and astigmatism post-surgery. The gender distribution, however, was not significantly similar to our study sample.

Another study conducted showed contrary results. This study included Italian individuals. It revealed that the apical keratometry front (AKF) altered from 44.63±1.34D to 44.06±1.47D (p-value=0.002) after

six weeks of surgery. However, corneal astigmatism, central corneal thickness, and average simulated keratometry did not significantly change after the surgery. It was concluded that the pressure of the eyelid in Ptosis appears to induce steepening of the cornea. The surgical correction of Ptosis leads to more flattening with no adequate changes in astigmatism and cylindrical values.[12] One of the reasons for this may be the short follow-up of 6 weeks, which induced contrary results. This was explained by another study on thirty eyes of 30 individuals having a post-surgery follow-up at 1-month and 3-months. It revealed that 1-month after surgery, none of the measured parameters and variables showed any change. However, three months after surgery, corneal astigmatism was established to show a significant decrease from 1.2±0.3 D to 0.7±0.3 D (p=0.007). Furthermore, mean K revealed a significant reduction from 43.1±1.3 D to 42.2±1.5 D (p= 0.011). The visual acuity enhanced from 0.54±0.22 to 0.61±0.18 (p=0.285. It was concluded that surgical correction through ptosis surgery modifies the anterior corneal surface and restores the cornea's symmetry and astigmatism.[13] These results are consistent with our results, where the SimK, astigmatism, MDR, degree of Ptosis, levator function, and visual acuity improved significantly after ptosis surgery.

In a retrospective study in Tokyo Hospital, best-corrected visual acuity, astigmatism, central corneal thickness, and topographic data were assessed six months after surgery, similar to our study design. Thirty-two eyes of thirty-two patients were studied. It was revealed that there were no substantial changes in visual acuity and central corneal thickness after surgery, which was contrary to our results. However, mean K and corneal astigmatism substantially reduced after surgery. They suggested that corneal topographic values change six months after surgery.[14] Similar results regarding change in corneal astigmatism have been reported & supported by other studies as well.[15]

In another study, it was reported that visual acuity and cylindrical power change slightly after surgery. The results also supported that Corneal Thickness did not change significantly after surgery.[16] Another study specified that Cylindrical power, corneal topography, and central corneal thickness changes occur in specific cases, such as deepening the eyelid sulcus blepharoptosis only.[17] Similar to our study, a post-surgery decrease in cylindrical power of -0.3 D was observed in a study with improvement in visual acuity. However, the mean keratometry did not reveal a significant difference.[18] Similar results of no significant change in corneal topography post-surgery were supported by Zloto *et al.*[19]

CONCLUSION

Ptosis can lead to poor visual acuity and may cause a decreased quality of life. Hence, surgical procedures shall be performed considering the post-surgical topographic changes to ensure recovery from the refractive errors caused by the psychotic eyelids. Our study showed that post-surgery SimK, visual acuity, MRD, and cylindrical power improve significantly; however, CCT does not alter significantly. More research is warranted to elaborate on the parameters and facilitate recovery from refractive errors.

Conflict of Interest: None.

Author's Contribution

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

MN: & AHN: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

published.

MST: & NAK: Concept, drafting the manuscript, data interpretation, approval of the final version to be published.

SK: & AK: Study design, 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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