Original Research Article

Effectiveness of limbal relaxing incision for correction of post-operative astigmatism after phacoemulsification cataract surgery with intraocular lens implantation

Amarnath V Awargaonkar[1], Archana A Vare[2*], Varsha S Nandedkar[3], Sagar Janrao[4], Amruta Jiwane[4]

[1]Assistant Professor, [2]Associate Professor, [3]Professor & HOD, [4]Junior Resident, Department of Ophthalmology, Government Medical College, Aurangabad, Maharashtra, INDIA.
Email: archana_vare@rediffmail.com

Abstract

Background: There are ever increasing expectations of better refractive outcomes following cataract surgery like the expectation of no requirement of spectacles. However, for the best visual results, there is a need to minimize the effect of post-operative astigmatism. Options like implantation of toric intraocular lens implants, cataract incision for flattening, astigmatic keratotomy, or post-operative correction by Limbal relaxing incisions (LRI) are available to overcome the astigmatism present after cataract surgery. **Methods:** Thirty seven patients that underwent Phacoemulsification surgery for cataract with posterior chamber foldable or rigid intraocular lens insertion by temporal incision and required correction of astigmatism afterwards were included. **Results:** The study comprised of 37 patients that underwent Limbal relaxing incision (LRI) in the study groups. It included 13 patients (35.1%) from group I and 24 patients (64.9%) from group II. There was no significant difference in the peripheral Pachymetry, correction aimed, correction achieved and final astigmatism in the two groups. Also, there was no significant difference in the mean residual astigmatism on day 1, 7 and 42 between the two groups. Before LRI, there was statistically significant difference in the type of astigmatism in the two groups. Maximum patients in group I had 'against the rule' astigmatism whereas maximum patients in group II had 'with the rule' astigmatism. After LRI, there was no significant difference in the type of astigmatism between the two groups. All the patients in group I and group II had achieved uncorrected visual acuity of 6/6 on day 42. None of the patients required correction for distance vision after LRI. **Conclusions:** From study observations it can be concluded that Limbal relaxing incisions were successful in achieving emmetropia in patients with residual astigmatism after 6 weeks of Phacoemulsification cataract surgery with foldable or rigid intraocular lens implantation.
Key Word: Visual acuity, Cylinder, Cornea.

***Address for Correspondence:**
Dr. Archana A Vare, Department of Ophthalmology, Government Medical College, Aurangabad, Maharashtra, INDIA.
Email: archana_vare@rediffmail.com
Received Date: 21/03/2019 Revised Date: 09/05/2019 Accepted Date: 27/06/2019
DOI: https://doi.org/10.26611/10091111

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 03 July 2019

INTRODUCTION

Cataract surgery is considered to be the most usual refractive procedure performed across the globe. The outcome of cataract surgery has vastly improved with the advent of improved tools for intraocular lens power calculation allowing complete spherical correction of pre-existing refractive error.[1,2] There are ever increasing expectations of better refractive outcomes following cataract surgery like the expectation of no requirement of spectacles. [3] However, for the best visual results, there is a need to minimize the effect of post-operative astigmatism. Options like implantation of toric intraocular

How to cite this article: Amarnath V Awargaonkar, Archana A Vare, Varsha S Nandedkar, Sagar Janrao, Amruta Jiwane. Effectiveness of limbal relaxing incision for correction of post-operative astigmatism after phacoemulsification cataract surgery with intraocular lens implantation. *MedPulse International Journal of Ophthalmology.* July 2019; 11(1): 01-04. https://www.medpulse.in/Ophthlmology/

lens implants, cataract incision for flattening, astigmatic keratotomy, or post-operative correction by Limbal relaxing incisions are available to overcome the astigmatism present after cataract surgery. [2,4] Limbal relaxing incisions have been reported to be simple, safe, as well as an effective method for the correction of primary mixed astigmatism or mixed astigmatism after cataract surgery with a neutral effect on the corneal aberrations. [5,6] Although Limbal relaxing incisions are a weaker corrective procedure as compared to corneal relaxing incisions; they produce less post-operative glare and less patient discomfort. Also, these incisions heal faster. Unlike corneal relaxing incisions, making the incision at the limbus preserves the perfect optical qualities of the cornea. Limbal relaxing incisions are also a more forgiving procedure, and surgeons often get excellent results even with early cases. [4,6] Limbal relaxing incisions are useful in correcting astigmatism with the help of which there is a possibility of achieving almost emmetropia. [7] The present study was done to assess the effectiveness of Limbal relaxing incision for correction of post-operative astigmatism after Phacoemulsification cataract surgery with intraocular lens implantation.

METHODS

The present study is a prospective observational study done at the Ophthalmology Department of a tertiary care centre in Maharashtra. 37 patients that underwent Phacoemulsification surgery for cataract with posterior chamber foldable or rigid (non-foldable) intraocular lens insertion by temporal incision and required correction of astigmatism afterwards were included. Based on the type of intraocular lens implant, division into two groups irrespective of the type of astigmatism was done. Group one included 13 cases that underwent Phacoemulsification cataract surgery with temporal corneal tunnel (2.8mm) incision and foldable PCIOL insertion followed by Limbal relaxing incision procedure for correction of astigmatism present after 6 weeks of cataract surgery. Group two included 24 cases that underwent Phacoemulsification cataract surgery with extended temporal corneal tunnel (5.3 – 5.5 mm) incision and rigid PCIOL insertion followed by Limbal relaxing incision procedure for correction of astigmatism present after 6 weeks of cataract surgery. Patients with a history of any prior ocular surgery, retinal detachment, corneal disorders like corneal opacity, corneal thickening or decreased corneal clarity; severe external eye disease, uncontrolled preoperative glaucoma, history of long term steroid use or irregular astigmatism were excluded. All standard protocols for surgical intervention were followed. Before Limbal relaxing incision procedure, difference in keratometric readings of the horizontal and vertical axis was taken as corneal astigmatism in dioptre cylinder. It was noted by Keratometry and was converted into dioptre cylinder for application of nomograms. Post the Limbal relaxing incision procedure, Keratometry was checked on day 1, day 7 and day 42. The readings of Keratometry, uncorrected visual acuity and best corrected visual acuity were taken before and at 42 days post Limbal relaxing incision procedure. The extent to which astigmatism altered was noted. Difference in K readings of two axes was taken as corneal astigmatism in D cylinder. Correction achieved was calculated by subtracting Post Limbal relaxing incision corneal astigmatism in D cylinder from the Pre Limbal relaxing incision corneal astigmatism in D cylinder as determined by Keratometry and not by patients subjective acceptance of cylinder. Change in uncorrected visual acuity and best corrected visual acuity was recorded. Data were entered in Microsoft Excel spreadsheet. The analysis was done to assess the statistical significance of study parameters and p-value < 0.05 was considered as statistically significant.

OBSERVATIONS

There were 37 patients that underwent Limbal relaxing incision (LRI) in the study groups. It included 13 patients 35.1%) from group I and 24 patients (64.9%) from group II.

Table 1: Pre and Post LRI Corneal Astigmatism and Peripheral Pachymetry in the Study Groups

Variables after LRI	Group I (Foldable PCIOL)			Group II (Rigid PCIOL)			p value*
	n	Mean	SD	n	Mean	SD	
Correction aimed (+D cylinder)	13	1.5	0.44	24	1.5	0.37	**0.774 (NS)**
Correction achieved	13	1.4	0.51	24	1.4	0.28	**0.906 (NS)**
Peripheral Pachymetry (microns)	13	688.6	16.01	24	693.4	26.22	**0.503 (NS)**
Final Astigmatism (D cylinder)	13	0.1	0.15	24	0.13	0.12	**0.586 (NS)**

NS: Statistically not significant. SD: Standard Deviation. * Independent Sample t Test used

Table 2: Residual Keratometric Astigmatism after LRI in the Study Groups

Residual Keratometric Astigmatism after LRI	Group I (Foldable PCIOL)			Group II (Rigid PCIOL)			p value*
	N	Mean	SD	n	Mean	SD	
Day 1	13	0.25	0.44	24	0.08	0.27	**0.154 (NS)**
Day 7	13	0.23	0.12	24	0.26	0.2	**0.583 (NS)**
Day 42	13	0.09	0.16	24	0.12	0.13	**0.586 (NS)**

NS: Statistically not significant. SD: Standard Deviation. * Independent Sample t Test used

Table 3: Type of Pre and Post LRI Astigmatism in the Study Groups

Pre and Post LRI in Study groups		Type of Astigmatism			Total	p value*
		No Astigmatism	Against the Rule Astigmatism	With the Rule Astigmatism		
Before LRI at day 42 of cataract surgery	**Group I (Foldable PCIOL)**	0	12	1	**13**	**0.001 (S)**
	Group II (Rigid PCIOL)	0	8	16	**24**	
After LRI	**Group I (Foldable PCIOL)**	10	3	0	**13**	**0.092 (NS)**
	Group II (Rigid PCIOL)	12	5	7	**24**	

S: Statistically significant. NS: Statistically not significant. * Chi Square Test used

Table 4: Snellen's Distance Visual Acuity after LRI in the Study Groups

Uncorrected Visual Acuity after LRI (Day 42)	Group I	Percentage	Group II	Percentage
6/6	13	100	24	100
Total	**13**	**100**	**24**	**100**

DISCUSSION

The present study results showed that after LRI, there was no significant difference in the type of astigmatism between the two groups. All the patients in group I and group II had achieved uncorrected visual acuity of 6/6 on day 42. None of the patients required correction for distance vision after LRI. LRI consists of making two small curvilinear cuts at the limbus which causes a change in the curvature of the cornea. LRI produces a flattening of meridian at the site due to the addition of tissue and simultaneously they cause an incurve of the perpendicular meridian i.e. the fitting together effect. [8-10] Coloma-González I *et al*. reported LRI as a safe as well as an effective way to reduce any pre-existing astigmatism during cataract surgery and importantly it provides good unaided visual acuity. [10] Lim R *et al* further evaluated the long term stability of keratometric effects of LRI and reported that the keratometric effects of LRI were stable at 10 weeks to 3 years after the surgery. [11] Sharma and Kumar study evaluated LRI when done along with cataract surgery and concluded that LRI can reduce preoperative astigmatism effectively and with a good predictability of the angle. [7] Pisella PJ reviewed that residual astigmatism observed after cataract surgery can be corrected by classic LRI technique which is an easy procedure to perform but has limited precision.[12] In a recent review by Michelle Stephenson on the current significance of LRI as a refractive surgery, it has been highlighted that although toric IOLs and excimer laser photoablation are superior options for management of moderate to severe astigmatism, still LRI have an important place in relation to treatment of smaller degrees of astigmatism and it was stressed that every ophthalmic surgeon should be well versed with this technique. Most importantly, the author put forth that LRI have a definite role in management of residual astigmatism after cataract surgery as the tolerance of the patients for post operative astigmatism has gone down and manual LRI can significantly reduce the post operative astigmatism. [13] This may well explain the results of the present study. Ravikumar K *et al*. study had also found that LRI can be used to reduce astigmatism of <3D at corneal level and significantly help in achieving spectacle free distant vision in the patients. [14] The study limitations are small number of patients and study design does not have an experimental and randomisation component limiting the validity. The follow up duration was also less. Future studies can further explore and establish the role and utility of LRI in management of post operative astigmatism.

CONCLUSIONS

From study observations it can be concluded that Limbal relaxing incisions were successful in achieving complete emmetropia in patients with residual astigmatism after 6 weeks of Phacoemulsification cataract surgery with foldable or rigid intraocular lens implantation.

REFERENCES

1. Kershner RM. Refractive cataract surgery. Curr Opin Ophthalmol 1998; 9(1):46-54.
2. Zare M A, Hosseini TM, Gohari M, Jabbarvand M, Hashemian MN, Mohammadpour M, *et al*. Management of Corneal Astigmatism by Limbal Relaxing Incisions during Cataract Surgery. Iranian Journal of Ophthalmology. 2010; 22 (1):15-20
3. Nichamin LD. Treating astigmatism at the time of cataract surgery. Curr Opin Ophthalmol 2003; 14(1):35-8.
4. Gills JP. Treating astigmatism at the time of cataract surgery. Curr Opin Ophthalmol. 2002 Feb; 13(1):2-6.
5. Eliwa TF, Abdellatif MK, Hamza II. Effect of Limbal Relaxing Incisions on Corneal Aberrations. J Refract Surg. 2016 Mar;32(3):156-62.
6. Bayramlar H, Dağlioğlu MC, Borazan M. Limbal relaxing incisions for primary mixed astigmatism and mixed astigmatism after cataract surgery. J Cataract Refract Surg. 2003 Apr; 29(4):723-8.
7. Sharma BR, Kumar A. Preliminary experiences with Limbal relaxing incision for treatment of astigmatism during Phacoemulsification. Nep J Oph 2009; 1(2):90-94.
8. Morlet N, Minassian D, Dart J. Astigmatism and the analysis of its surgical correction. Br J Ophthalmol 2001; 85: 1127-1138.
9. Alpins N. A re-analysis of astigmatism correction (letter). Br J Ophthalmol 2002; 86: 832.
10. Coloma-González I, González-Herrera M, Mengual-Verdú E, Hueso-Abancens JR. [Limbal relaxing incisions and cataract surgery: our experience]. Arch Soc Esp Oftalmol. 2007 Sep; 82(9):551-4.
11. Lim R, Borasio E, Ilari L. Long-term stability of keratometric astigmatism after limbal relaxing incisions. J Cataract Refract Surg. 2014 Oct; 40(10):1676-81. doi: 10.1016/j.jcrs.2014.01.045. Epub 2014 Aug 22.
12. Pisella PJ. [Post-operative residual astigmatism after cataract surgery: Current surgical methods of treatment]. J Fr Ophtalmol. 2012 Mar; 35(3):226-8.
13. Michelle Stephenson. Is There Still a Place For Manual LRIs? Review of Ophthalmology. 2018; Feb: 36-38
14. Ravikumar K, Arthi. M, Rajakumari. A study on efficacy of limbal relaxing incisions in correcting corneal astigmatism along with clear corneal phacoemulsification in a tertiary eye care centre in South India. Int J Med Res Rev 2017; 5(02):168-175.

Source of Support: None Declared
Conflict of Interest: None Declared