Original Article
Pak Armed Forces Med J 2018; 68 (6): 1533-37

EFFECT OF USING VERION IMAGE GUIDED SYSTEM ON SURGICALLY INDUCED ASTIGMATISM (SIA) IN PATIENTS UNDERGOING CATARACT SURGERY

Asad Habib, Muhammad Saim Khan, Mazhar Ishaq

Armed Forces Institute of Ophthalmology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To analyze the effect of use of VERION image guided system on surgically induced astigmatism (SIA) in patients undergoing cataract surgery

Study Design: Randomized controlled trial.

Place and Duration of Study: The study was conducted at Armed Forces Institute of Ophthalmology, Rawalpindi, Pakistan from Aug 2016 to Dec 2016.

Material and Methods: Sixty eyes undergoing cataract surgery with already existing corneal astigmatism of at least 0.5 diopter (D) were included in the study. Cases with already existing ocular pathology or any per operative complication were excluded. Non-probability (purposive) sampling technique was used. Patients were randomly grouped into two groups 1 and 2. Group-1 underwent normal conventional phacoemulsification with no specific predetermined incision site. Group-2 underwent keratometric assessment using VERION image guided system and data was transferred to operating microscope. Steep and flat meridian were displayed on screen and incision were made on steep axis. Pre and 2 week post op keratometric readings were noted on a workup performa for both the groups and compared. All the surgeries were done by the same surgeon. Statistical program for social sciences (SPSS) version 23.0 was used for statistical analysis.

Results: Sixty eyes (29 male, 31 female) with mean age of 57.65 ± 7.41 years were studied. Group-1 included 30 eyes with mean age of 56.73 ± 9.16 years. Group-2 also included 30 eyes with mean age of 58.56 ± 5.10 years. Mean pre op astigmatism was 0.93 ± 0.45D and 0.88 ± 0.47 D in group 1 and 2 respectively. Mean post op astigmatism was 0.95 ± 0.43 and 0.50 ± 0.39 in group 1 and 2 respectively Mean SIA in group-1 was 0.54 ± 0.43. Diopters while that in group 2 was 0.55 ± 0.36 diopters. Mean residual astigmatism -0.016 ± 0.43 and 0.37 ± 0.24 D in groups 1 and 2 respectively showing a 42% reduction in astigmatism in group 2 as compared with 1.7% increase in group 1.

Conclusion: There is no significant difference between the SIA between two groups however there was a significantly less residual astigmatism in VERION group (group 2). Verion assisted incision along the steep axis is helpful in achieving a better refractive outcome in patients undergoing cataract surgery.

Keywords: Astigmatism, Cataract, Phacoemulsification, Verion.

INTRODUCTION

Astigmatism is state of refraction where in the refractive power varies in the different meridian such that the rays of light entering the eye cannot converge to a point focus but form focal lines. Pre operative eyes always have a steep and flat meridian no matter how small the difference may be. Surgical procedures on cornea, site and quality of incision and sutures effect the power of these meridian causing increase or decrease in astigmatism[1] having variable effects on post operative visual outcome[2]. Pre-op astigmatism can be corrected surgically by inserting toric IOL or giving relaxing incison in specified meridian. Post op astigmatism thus induced depends on already existing astigmatism and surgically induced astigmatism[3,4]. SIA or surgically induced astigmatism depends on site and size of incision and pre-operative astigmatism. Small sutureless incision reduces post op astigmatism compared with large incision of extracapsular lens extraction (ECCE). Measuring corneal astigmatism thus has both diagnostic and therapeutic implications wherein an incision can be placed during cataract surgery in such a way so as to reduce already existing

Correspondence: Dr Asad Habib, Department of Ophthalmology, Armed Forces Institute of Ophthalmology Rawalpindi Pakistan
Email: asadhabib79@gamil.com
Received: 02 Aug 2017; revised received: 18 Mar 2018; accepted: 09 Apr 2018

astigmatism. Various methods of calculating corneal astigmatism and calculators for surgical induced astigmatism exist. Classic formula for SIA calculation was described over 100 years ago. Jaffe's work, Martin and Welford's formulation and Cravy used keratometric readings and trigonometric methods. Koch and Russel in 1991 eliminated inconsistencies in cravy's formula. Hall *et al* published explicit formulas in 1991[5]. Holladay *et al*[16] devised a 10 step approach of calculating SIA using mathematics in 1992. Lakshminarayanan used matrix and algebra[7]. These mathematical, trigonometric and algebraic solutions are basis for today's modern formulae and computer programs for calculating astigmatism. VERION Image guided system is a collection of reference, planning units and digital marker to access, plan and guide the surgeon throughout surgical procedure aiming to minimize the post op residual astigmatism. Accessing the steep and flat meridians and planning incision sites and finally using digital marker to help make incisions improve the overall outcome of cataract surgery. Elhofi et al found out that VERION is efficient in reducing the residual astigmatism after cataract surgery by helping correct placement of Toric IOLs[8]. Armed Forces institute of ophthalmology is a tertiary care hospital and has recently acquired VERION image guided system. The rationale of conducting this study is to assess the efficacy of VERION image guided system in reducing the residual astigmatism in our population undergoing cataract surgery.

MATERIAL AND METHODS

The randomized controlled trail study was conducted at Armed Forces Institute of Ophthalmology from August 2016 to December 2016 on 60 eyes. Non-probability (purposive) sampling technique was used. Both male and female patients undergoing cataract surgery with a minimum pre-operative astigmatism of 0.5 diopters (D) were included. Patients with corneal dystrophies, ocular trauma, previous ocular surgery, corneal ecstasies and those who used contact lens in the past 4 weeks were excluded. Patient with any per-operative complication like posterior capsule rupture, vitreous loss, anterior chamber lens (ACIOL), sulcus or scleral fixation IOL placement and those with post op endo-pthalmitis were also excluded from the study. After approval by the ethical committee informed consent was taken from all the patients prior to inclusion in the study. All Patients were randomly divided into two groups using Non-probability (purposive) sampling. Registered patients were subjected to pre op keratometric assessment using automated refrecto-keratometer

Table-I: Frequency table.

		N	% Age
Gender	Male	29	48.3
	Female	31	51.7
Eye	Right	32	53.3
	Left	28	46.7
Group	Control (1)	30	50
	Study (2)	30	50

Table-II: Group Statistics.

Variable	Control (1)	Study (2)	Sig (P)
Mean age	56.73 ± 9.16	58.56 ± 5.01	0.342
Mean preop cyl	0.93 ± 0.45	0.87 ± 0.47	0.637
Mean post op cyl	0.95 ± 0.43	0.50 ± 0.39	<0.001
Mean SIA	0.54 ± 0.43	0.55 ± 0.36	0.92
Mean Residual astigmatism	-0.016 ± 0.43	0.37 ± 0.23	<0.001

(ARK, NIDEK TONOREF II JAPAN). Group 1 (control group) underwent conventional phacoemulsification with no special consideration of incision placement. Temporal incision was used in both right and left eyes (125-135 degree for right and 45-55 degree for left eyes)

Group 2 (study group) underwent pre-op assessment by VERION image guided system (Alcon). A high definition reference image was created and registered intraoperatively using scleral/limbal vasculature and iris contour. Steep axis was digitally marked and displayed on screen during surgery and incision placed on this very axis.All surgeries were done by the same surgeon and 2.75 keratome was used in all cases. All patients were reviewed 2 weeks (mean 14.25 + 0.83 days) after surgery for keratometric assessment done by same ARK (NIDEK TONOREF II). Surgically induced astigmatism was calculated using online SIA calculator for both groups and residual astigmatism was calculated by subtracting post operative from pre operative diopter of astigmatism. All data was entered into a workup performa for analysis. Statistical package for social sciences (SPSS 23.0) for windows was used for comparative analysis. The continuous data was described in terms of mean ± SD (Standard deviation) while categorical data was depicted in frequencies for each group. Data was analyzed for significance by t-test. A *p*-values of <0.05 was considered statistically significant.

RESULTS

Sixty eyes (29 male, 31 female) with mean age of 57.65 ± 7.41 years were studied. Each Group included 30 eyes (table-I). Mean age of participants in group 1 was 56.73 ± 9.16 and that in group 2 was 58.56 ± 5.10 years (table-II). Group-I contained 13 males and 17 female while group 2 contained 16 males and 14 females. Both groups had no statistically significant difference between them (t=-0.958, *p*>0.001). The mean preoperative diopter of astigmatism for group 1 was 0.93 ± 0.45 D (range 0.5-2.0 D)

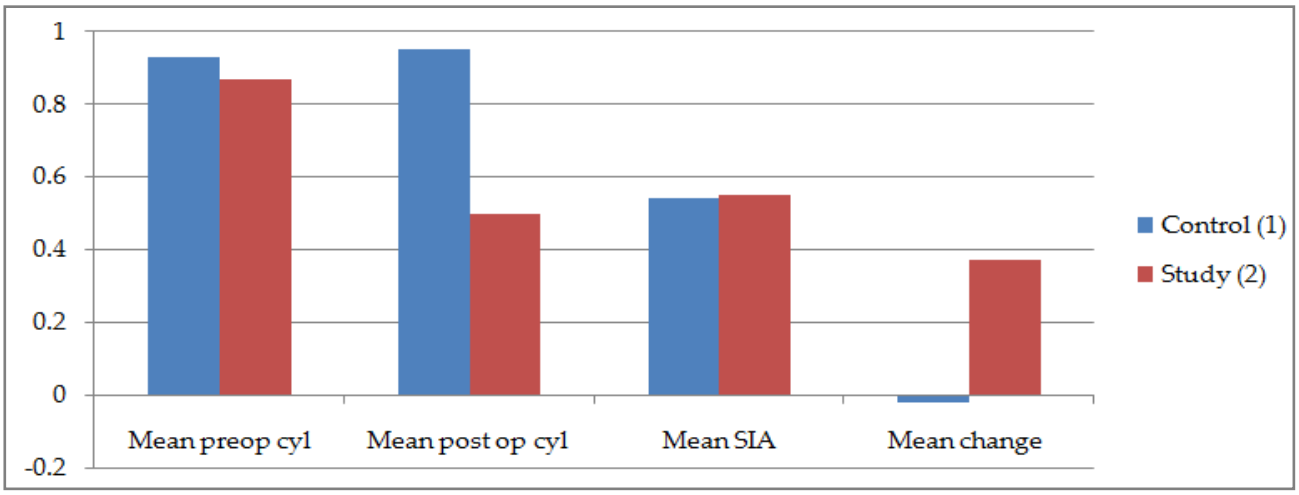

Figure: Mean pre and post op astigmatism, SIA and mean change in astigmatism between groups.

And that for group 2 was 0.88 ± 0.47 D (Range 0.5-2.75 D). Both the groups had no statistically significant difference between them (*p*>0.001). However we found a statistically significant difference in mean post op astigmatism between two groups (0.95 ± 0.43 and 0.50 ± 0.39 in group 1 and 2 respectively with *p*<0.001) (table-II). Mean SIA in group 1 was 0.54 ± 0.43. Diopters while that in group 2 was 0.55 ± 0.36 diopters which was not statistically different (*p*>0.001). Mean residual astigmatism (difference between pre and post op astigmatism) for group 1 was-0.016 ± 0.43 which showed a 1.72% increase in astigmatism 2 weeks post operatively however for group 2 (VERION group) mean residual

astigmatism was 0.37+0.24D, which showed a 42% reduction in pre op astigmatism at same post op duration (figure). This showed statistically significant less residual astigmatism in VERION group. (t=-4.33, p<0.001)

DISCUSSION

Patient is generally not satisfied with the surgical result if in any case he or she still needs to wear spectacles after cataract surgery. Various methods of post op astigmatism reduction are available including incision placement techniques and toric IOL insertion. Some studies found out a determining relationship with the site of incision, temporal incision been most preferred while other didn't find any association[9-13]. Main incision of cataract can be placed along the steep meridian so as to render it flat. limbal relaxing incisions can be given in the end to reduce post op astigmatism. Currently femtosecond laser assisted cataract surgery (FLACS) is also helpful in this regard[14]. One important question in this regard is what methodology should be used in assessing and marking of steep meridian. The efficient the method is, the better the post op results will be. Various methods of incision placement like horizontal slit beam marking, subjective direct visual marking, manual slitlamp-assisted pendulum-attached marker, and have been studied in literature. Lin *et al*[15] compared these manual methods with digital VERION image guided system and found out that inaccuracy and misalignment in measurement of astigmatism was least in VERION as compared with other methods and thus can be of help in reducing post op astigmatism, however the topic has not been studied in detail previously. literature search showed that role of VERION was studied by Ehlofi *et al* who compared the effect of toric and manual marking for toric IOL placement[8]. They found VERION a helpful tool in this regard. It resulted in significanlty less post op residual astigmatism (p=0.001) and less toric IOL misalignment (p=0.003) as compared to manual method. We studied the effect of incision placement on surgically induced astigmatism and residual astigmatism using VERION image guided system without any toric IOL implantation. Our study included 60 eyes that underwent routine cataract surgery. Thirty eyes were included in each group. Both the groups had no statistically difference between them with regards to gender, age, laterality of eye and mean post op visit duration. We found no statistically significant difference of SIA between the groups. However the amount of astigmatism left 2 week after surgery was significantly less in VERION group as compared with control group. Ehlofi *et al* also reported a significanlty less residual astigmatism in VERION group[8]. Our study showed a significant reduction in post op astigmatism and less residual astigmatism in patient in which VERION was used. Our study highlights that VERION can be used as a beneficial tool in planning incision marking in patients undergoing cataract surgery in order to reduce post op astigmatism and need of spectacles. Surgically induced astigmatism was however not statistically different between the groups.

LIMITATION OF THE STUDY

Limitations of our study were less sample size and random incision site in group one. Further controlled trial on a larger sample size need to be done in this regard.

CONCLUSION

There is no significant difference between the SIA between two groups however there was a significantly less residual astigmatism in VERION group (group 2). VERION assisted incision along the steep axis is helpful in achieving a better refractive outcome in patients undergoing cataract surgery.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Henderson B, Pineda R., Ament C, Chen S, Kim, J. Essentials of Cataract Surgery. Slack Incorporated, Online Library. 2007 Chapter 2.
2. Kohnen T. Corneal Shape Changes and Astigmatic aspects of scleral and corneal tunnel incisions. J Cataract Refract Surg 1997; 23: 301-302.

3. Albert DM, Miller JW, Azar DT, Blodi BA. Principles and practice of ophthalmology. 3rd edition, saunders company, Philadelphia, 2008 Chap-120.
4. Henderson B, Pineda R, Ament C, Chen S, Kim J. Essentials of cataract surgery. slack incorporated, online library, 2007 Chp-7.
5. Hall GW, Campion M, Sorenson CM, Monthofer S. Reduction of corneal astigmatism at cataract surgery. J Cataract Refract 1991; 17(4): 407-14.
6. Holladay JT, Cravy TV, Koch DD. "Calculating the surgically induced refractive change following ocular surgery,"J Cataract Refract Surg 1992; 18(5): 429-43.
7. Lakshminarayanan V. Calculation of induced astigmatism due to cataract surgery using lens power matrices. Eur J Impl Ref Surg 1992; 4(4): 227-30.
8. Elhofi AH, Helaly HA. Comparison between digital and manual marking for toric intraocular lenses: a randomized trial. medicine 2015; 94(38): e1618.
9. Kohnen S, Neuber R, Kohnen T. Effect of temporal and nasal unsutured limbal tunnel incisions on induced astigmatism after phacoemusification J Cataract Refract Surg 2002; 28: 821-25
10. Ozkurt Y, Erdogan G, Guveli AK. Astigmatism after superonasal and superotemporal clear corneal incisions in phacoemulsification. Int Ophthalmol 2008; 28: 329-32
11. Ermiş SS , Inan ÜÜ, Öztürk F. Surgically induced astigmatism after superotemporal and superonasal clear corneal incisions in phacoemulsification. J Cataract Refract Surg 2004; 30(6): 1316-9.
12. He Y, Zhu S, Chen M, Li D. Comparison of the keratometric corneal astigmatic power after phacoemulsification: clear temporal corneal incision versus superior scleral tunnel incision J Ophthalmol 2009; 2009: 210621.
13. Altan-Yaycioglu R, Akova YA, Akca S, Gur S, Oktem C. Effect on astigmatism of the location of clear corneal incision in phacoemulsification of cataract. J Refract Surg 2007; 23(5): 515-8.
14. Blehm C, Potvin R. pseudophakic astigmatism reduction with femtosecond laser-assisted corneal arcuate incisions: a pilot study. Clin Ophthalmol 2017; 11: 201.
15. Lin HY, Fang YT, Chuang YJ, Karlin JN, Chen HY, Lin SY, et al. A comparison of three different corneal marking methods used to determine cyclotorsion in the horizontal meridian. Clin Ophthalmol 2017; 11: 311.

.....