

Pattern of Preoperative Astigmatism in Patients in South East Nigeria as Determined by Biometry

A. Kalu^{1*}, O.I Otuka¹, L. Eweputana¹, K. U. Nwachukwu² and J. K. Ume³

¹Ophthalmology Unit, Department of Surgery, Abia State University Uturu, Abia State, Nigeria.

²Department of Ophthalmology, UCTH Calabar, Cross River State, Nigeria.

³Anya Specialist Eye Clinic, Umuahia, Abia State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/OR/2020/V13i330170

Editor(s):

(1) Dr. Tatsuya Mimura, Tokyo Women's Medical University Medical Center East, Japan.

Reviewers:

(1) Naresh Babu Kannan, Aravind Eye Hospital, India.

(2) M. Arish D. O., Frcs Edin, Zahedan University of Medical Sciences, Iran.

(3) Paulo Ricardo Pereira de Oliveira, Universidade Luterana do Brasil (Ulbra), Brazil.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/60557>

Original Research Article

Received 27 June 2020
Accepted 01 September 2020
Published 05 September 2020

ABSTRACT

Background: Astigmatism is an error of refraction that can affect visual outcome after cataract surgery. The degree of astigmatism is usually estimated pre-operatively by keratometry readings. These readings can help in the plan of surgical technique and choice of intraocular lenses during cataract surgery in order to improve visual outcome. This study was done to provide data on the pattern of preoperative astigmatism in cataract patients in South East Nigeria. It is hoped that this knowledge will increase the awareness on pre-operative astigmatism among ophthalmologist so that they can improve their surgical skills on ways of reducing this astigmatism or avoid worsening it.

Methods: A retrospective review of keratometry readings of 533 patients were taken from June 2018 to December 2019, with emphasis on the cylinders.

Results: The most common degree of astigmatism was -0.75DC. The proportion of patients with preoperative astigmatism \leq -1.00DC was 60% while 40% had values higher than -1.00DC.

Conclusion: There may usually be significant pre-operative astigmatism in patients scheduled for cataract surgery. This calls for an improvement in surgical skills in minimizing astigmatism and avoiding worsening preoperative astigmatism. There should be increase availability and use of toric lenses for correction of preoperative astigmatism. Finally accurate postoperative refraction will have a positive impact in the management of astigmatism, whether preoperative or surgically induced.

Keywords: Astigmatism; biometry; error of refraction; cataract surgery.

1. INTRODUCTION

The human eyes are specialized sense organs that are capable of receiving visual images, which are then relayed to the brain for interpretation. It could be compared to a camera, in that it has refracting structures – the cornea and lens, which helps refract and focus light rays on the retina – which could be likened to a camera film. Hence, image is perceived clearly when parallel rays of light coming from infinity are focused on the retina. This takes place when the refracting structures of the eyes are optimal.

However, there are certain refraction abnormalities, known as Errors of Refraction, which leads to conditions whereby light rays are made to focus either in front of the retina (Myopia), behind the retina (Hyperopia), or the light rays are unable to meet at a focal point because of variation of refraction in different meridians of the eye (Astigmatism) [1].

Astigmatism could be either Regular or Irregular. Astigmatism is said to be regular when the refractive power changes uniformly from one meridian to another; there are two principal meridians. It is said to be irregular when there's an irregular change of refractive power in different meridians; there are multiple meridians [1].

Depending upon the axis and the angle between the two principal meridians, Regular Astigmatism can be classified into: -

- With-the-rule Astigmatism; the 2 principal meridians are horizontal & vertical, and are placed at right angles to one another. However, the vertical meridian is more curved than the horizontal.
- Against-the-rule Astigmatism; here, the horizontal meridian is more curved than the vertical meridian.
- Oblique Astigmatism: the 2 principal meridians are not horizontal & vertical but are at right angle to each other.
- Bi-oblique: Astigmatism; the 2 principal meridians are not at right angle to each other.

Depending upon the position of the 2 focal lines in relation to retina, it can be further classified into: -

- Simple Astigmatism: where the rays are focused on the retina in one meridian, and either in front (Simple Myopic Astigmatism)

or behind (Simple Hyperopic Astigmatism) the retina in the other meridian.

- Compound Astigmatism: where rays of light in both meridians are focused either in front (Compound Myopic Astigmatism) or behind (Compound Hyperopic Astigmatism) the retina.
- Mixed Astigmatism: Where light rays in one meridian are focused in front of the retina and the other behind the retina.

Astigmatism could be caused by conditions that lead to abnormalities in the curvature of the cornea or of the lens, or a tilted or obliquely positioned lens. Often times, cataract surgery induces significant astigmatism, or worsens existing astigmatism [2]. A good proportion of patients may have significant preoperative astigmatism [3].

Patients with astigmatism usually complain of blurry vision, distortion of object shape and asthenopic symptom (dull eye pain, headache, eye fatigue, drowsiness). Some may assume a head tilt position (torticollis) in an attempt to bring their axes nearer to the horizontal or vertical meridians. Some may also present with half closure of the eyelids, so as to produce a stenopaeic vision.

Astigmatism could be corrected optically; by the use of cylindrical lenses in form of spectacles or contact lenses, surgically via Laser in-situ Keratomileusis (LASIK), Photo-astigmatic refractive Keratotomy (PARK) and Astigmatic Keratotomy (AK). Cataract surgery has also been used to correct or modify pre-existing astigmatism to improve visual outcomes. Thus it is important to know the magnitude of an existing astigmatism which could guide on type of surgical incisions to make and the axes where the incisions can correct or reduce the astigmatism. There are also sphero-cylindrical (or toric) intraocular lenses which can be used to correct astigmatism after cataract surgery [4].

Many developing countries like Nigeria do not have adequate access to cylindrical or toric intraocular lenses to correct astigmatism, or where they are available the cost may be prohibitive. There is paucity of data on the pattern of pre-operative astigmatism in Nigeria hence this study. Living in this part of the world where records are not well kept, this study was therefore undertaken to provide further data for future references.

2. METHODS

This is a retrospective review of patients' preoperative Keratometry readings in Anya Specialist Eye Clinic, Umuahia Abia State Nigeria between June 2018 to December 2019. The keratometry was done with an autorefractor – (UNICOS; URK-700; s/n: K7QLB9K) performed with the autorefractor in “auto-mode” during biometry pre-operatively. The “auto-mode” removes inter-operator bias/errors.

Cylindrical readings were recorded from the biometry results. These cylindrical readings were not prescribed for the patients.

3. RESULTS AND DISCUSSION

A total number of 533 cylinder readings were recorded from the biometry results. These included both children and adults.

Table 1 shows the frequency of different degrees of astigmatism recorded from patients. The range of distribution of astigmatic power in the eyes from the study was between -0.25DC to -9.00 diopetre cylinder (DC).

It can be seen that the commonest value of astigmatism was -0.75 DC, making up 17.6% of the recorded values. Sixty percent (60%) of the patients had pre-operative astigmatism of -1.00DC or less, 40% had values above -1.00DC while 16.9% had values above -2.00 DC.

A plot of the cylinder powers against the frequency shows an initial steep rise with a peak at -0.75, a steep decrease from -0.75 to -1.50 and a gradual decline to higher astigmatic values (Fig. 1).

Similar studies from Northern Nigeria and other countries; (China, Brazil, Bosnia & Herzegovina) showed that almost 50% of patients studied had preoperative corneal astigmatism equal to or greater than 1.00DC [5-8].

Table 1. Frequency of pre-operative astigmatism values

| S/N | Cylinder power | Frequency |
|-----|----------------|-----------|
| 1 | -0.25DC | 74 |
| 2 | -0.50DC | 93 |
| 3 | -0.75DC | 94 |
| 4 | -1.00DC | 59 |
| 5 | -1.25DC | 50 |
| 6 | -1.50DC | 27 |
| 7 | -1.75DC | 28 |
| 8 | -2.00DC | 18 |
| 9 | -2.25DC | 16 |
| 10 | -2.50DC | 15 |
| 11 | -2.75DC | 9 |
| 12 | -3.00DC | 10 |
| 13 | -3.25DC | 6 |
| 14 | -3.50DC | 7 |
| 15 | -3.75DC | 3 |
| 16 | -4.00DC | 2 |
| 17 | -4.25DC | 2 |
| 18 | -4.50DC | 5 |
| 19 | -4.75DC | 2 |
| 20 | -5.00DC | 2 |
| 21 | -5.25DC | 1 |
| 22 | -5.75DC | 2 |
| 23 | -6.00DC | 1 |
| 24 | -6.25DC | 1 |
| 25 | -6.50DC | 1 |
| 26 | -7.00DC | 2 |
| 27 | -7.50DC | 1 |
| 28 | -8.00DC | 1 |
| 29 | -9.00DC | 1 |

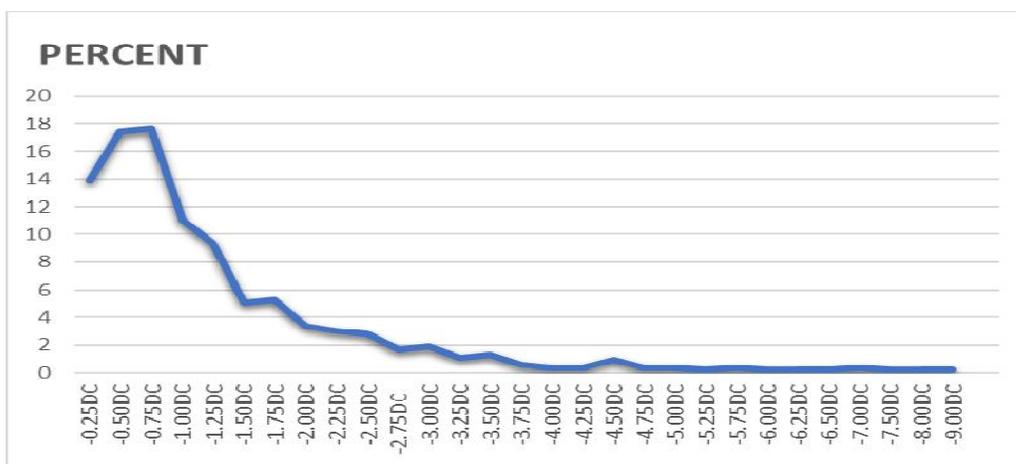


Fig. 1. Distribution of pre-operative astigmatism

4. CONCLUSION

There may usually be significant pre-operative astigmatism in patients scheduled for cataract surgery. This calls for an increased awareness for cataract surgeons to learn and improve their skills in the different incisions used to minimise or treat existing corneal astigmatism and avoid worsening the astigmatism with suboptimal surgical incisions. There should be increased availability and use of toric lenses for correction of preoperative astigmatism especially for higher values. Finally, accurate postoperative refraction will have a positive impact in the management of astigmatism, whether preoperative or surgically induced.

5. RECOMMENDATION

Cataract surgeons in Nigeria should be conversant with surgical steps and incisions that can reduce pre-operative astigmatism. Ophthalmologists and other stake holders in eyecare in Nigeria should also find ways of increasing the availability and affordability of toric lenses for cataract surgeries in Nigeria. Increased practice and experience in refraction is essential in correction of astigmatism postoperatively.

6. LIMITATIONS

At the time of collation of data for this study, the biometry print-outs which contained the information on the types and axes of astigmatism was not available and thus could not be included in the results.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline participant consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Cantor LB, Rapuano CJ, Cloffi GA. Clinical optics in basic and clinical science course 108–110 (American Academy of Ophthalmologists); 2018.
2. Imam A, Gilbert C, Sivasubramaniam S. Outcome of cataract surgery in Nigeria: Visual acuity autorefractometry and optimal intraocular lens powers—results from the Nigeria National survey. *Ophthalmology*. 2011;118:719–724.
3. Mohammed I, Syed A, Hassan S. Preoperative corneal astigmatism among adult patients with cataract in Northern Nigeria. *Indian J Ophthalmol*. 2014;62: 1094–1095.
4. Jaya, K. *et al*. Visual Outcomes after Phacoemulsification with AcrySof Intraocular lens implantation. *Niger. J. Ophthalmol*. 2016;24:62–66.
5. Zvornic J. Corneal astigmatism in cataract surgery patients from Bosnia and Herzegovina. 2019;8:1753–60.
6. Venkateswara HR, Hanumantha RK, Sivcharan KJN, Boyapati AD. Pre-operative corneal Astigmatism in patients with cataract. *J Evid Based Med Healthc*. 2015;2:4278–83.
7. Xiaoyong Y, Hui S, Gang P, Xia H, Xin T. Prevalence of corneal astigmatism in patients before cataract surgery in Northern China. *J Ophthalmol*; 2014.
8. Ladaveze E, Ortiz A, Visciarreli L, Cavatorta A. Corneal astigmatism in cataract surgery candidates. *Rev bras oftalmol*. 2018;77.

© 2020 Kalu et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/60557>