E-ISSN:2456-6454
P-ISSN:2581-4907
RNI:MPENG/2017/74152
Research Article
IOL

Tropical Journal of Ophthalmology and Otolaryngology

2021 Volume 6 Number 1 January-February

Publisher
MEDRESEARCH
www.medresearch.in

Comparison of corneal power estimated by IOL master and manual keratometry

Kumar P.[1], Sreevathsala T.[2], Tejaswini M.[3], Konda K.[4*]

DOI: https://doi.org/10.17511/jooo.2021.i01.04

[1] P. Sanjeeva Kumar, Associate Professor, Department of Ophthalmology, Santhiram Medical College and General Hospital, Kurnool, Andhra Pradesh, India.

[2] T. Sreevathsala, Assistant Professor, Department of Ophthalmology, Santhiram Medical College and General Hospital, Kurnool, Andhra Pradesh, India.

[3] M. Tejaswini, MBBS, Department of Ophthalmology, Santhiram Medical College and General Hospital, Kurnool, Andhra Pradesh, India.

[4*] Kavya Konda, Assistant Professor, Department of Ophthalmology, Santhiram Medical College and General Hospital, Kurnool, Andhra Pradesh, India.

Aim: To compare corneal power calculated by IOL master and manual keratometry. **Material & methods:** A prospective, consecutive, comparative & single-centre study was done in pre cataract surgery work up patients. Manual keratometry was done using Keratometer KMS-6 (Appasamy Associates, India) while automated keratometry was done with IOL master 500 (Carl Zeiss Meditec, Jena, Germany). SPSS version 20.0 was used for statistical analysis. **Results:** Overall agreement between two methods was excellent for horizontal corneal diopteric power (kappa = 0.53) & good for vertical corneal diopteric power (kappa = 0.46) using bland-altman analysis. **Conclusion:** Manual keratometry is still relevant in the era of digital automated keratometry measured by IOL master.

Keywords: IOL master, keratometry, Corneal Power

Corresponding Author

Kavya Konda, Assistant Professor, Department of Ophthalmology, Santhiram Medical College and General Hospital, Kurnool, Andhra Pradesh, India.
Email: kavyareddy012@gmail.com

How to Cite this Article

Kumar PS, Sreevathsala T, Tejaswini M, Konda K. Comparison of corneal power estimated by IOL master and manual keratometry. Trop J Ophthalmol Otolaryngol. 2021;6(1):18-21.
Available From
https://opthalmology.medresearch.in/index.php/jooo/article/view/180

To Browse

Manuscript Received	Review Round 1	Review Round 2	Review Round 3	Accepted
2021-01-04	2021-01-14	2021-01-24		2021-01-31

Conflict of Interest	Funding	Ethical Approval	Plagiarism X-checker	Note
No	Nil	Yes	8%	

Introduction

Accurate measurement of corneal power is essential for refractive surgery, orthokeratology, contact lens fitting, and intraocular lens (IOL) power [1,2].

Since conventional keratometers measure central corneal curvature (up to 3.25 mm in diameter), topographical systems are preferred over manual and autokeratometers for contact lens fitting and corneal refractive surgeries. In line with the digitization of various objective clinical measurements, a variety of auto-keratometers have been introduced and have rapidly gained widespread popularity among clinicians and vision scientists. Various keratometers are commercially available for clinical use. Manual (e.g. B&L and Javel-Schiotz Keratometer), automated (eg various autokeratorefractors, IOL Master) and devices for simulated keratometry (eg various corneal topographers) are the most common instruments. Since the working principles of different instruments vary, measurements are likely to differ from one to another. With an increasing trend of toric IOL implantation to correct pre-existing corneal astigmatism, precise determination of the strength and orientation of the corneal astigmatism is essential [3].

Though modern cataract surgery is a relatively simple procedure with arguably a high success rate, the refractive outcome is not always as perfect as a surgeon or a patient would like to have. The existence of significant post-operative residual spherocylindrical refractive errors is not uncommon. Along with several factors (e.g. error in axial length measurement, the inappropriate position of the implant, inaccuracy in the formula used in calculating IOL and surgically-induced refractive changes), inaccurate estimation of corneal power is one of the major sources of error [4].

Therefore, an accurate measurement of the corneal power is as important as the entire cataract surgical procedure. Currently, different keratometers are in use with varying levels of accuracy. Studies have reported conflicting results regarding the superiority of certain keratometers or that measurements performed with the IOLMaster or Pentacam can be used with sufficient accuracy [5,6,7,8,9].

This study was planned to find agreement between two commonly used keratometers viz. manual and IOL master, for different ranges of corneal power.

Material and methods

This prospective consecutive, comparative, single centre study was conducted over 2 months (January & February 2019). Cataract surgery posted patients requiring keratometry evaluation were included in the study after obtaining informed consent. Institutional ethics committee approval was obtained. Patients having corneal opacities, pterygium & inability to fixate the target for keratometry were excluded from the study. Manual keratometry was done using Keratometer KMS-6 (Appasamy Associates, India) while automated keratometry was done with IOL master 500 (Carl Zeiss Meditec, Jena, Germany).

Results

Total 222 eyes of 111 patients (61 females and 50 males) with a mean age of 61.6±10.3 years [Range: 24 – 88 years] were included in the study (Table 1 & 2). Table 3 shows agreement between two methods for horizontal & vertical corneal diopteric power for different diopteric ranges. Overall agreement between two methods was excellent for horizontal corneal diopteric power (kappa = 0.53) (Figure 1) & vertical corneal diopteric power(kappa = 0.46)(figure 2) using bland-altman analysis.

Table 1: Age-wise distribution

Age group (years)	No. of Cases	Percentage
21 – 30	01	0.9%
31 – 40	02	1.8%
41 – 50	12	10.8%
51 – 60	40	36.0%
61 – 70	39	35.2%
71 – 80	13	11.7%
>80	04	3.6%
Total	111	100%

Table 2: Gender-wise distribution

Gender	No. of Patients	Percentage
Male	50	45%
Female	61	55%
Total	111	100%

Table 3: Agreement between two methods for horizontal & vertical corneal diopteric power

Keratometry range (diopter)	Agreement (kappa) & Standard Error (SE)	
	For Horizontal Diopteric Power	For Vertical Diopteric Power
40.1 – 43 D	0.180 (SE 0.057)	0.181 (SE 0.057)
43.1 – 45 D	0.259 (SE 0.046)	0.201 (SE 0.061)

45.1 – 47 D	0.414 (SE 0.115)	0.224 (SE 0.120)
>47 D	0.333 (SE 0.0)	Not available
Overall	0.531 (SE 0.041)	0.461 (SE 0.047)

Bland-Altman analysis shows excellent agreement (kappa = 0.53) between the two methods.

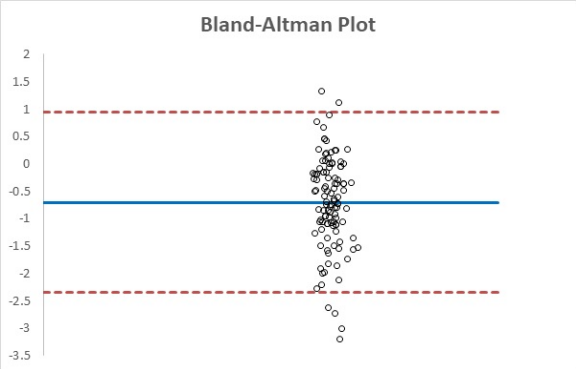

Fig-1: Agreement between Manual keratometry Vs IOL master for horizontal corneal diopteric power.

Bland-Altman analysis shows good agreement (kappa = 0.461) between the two methods.

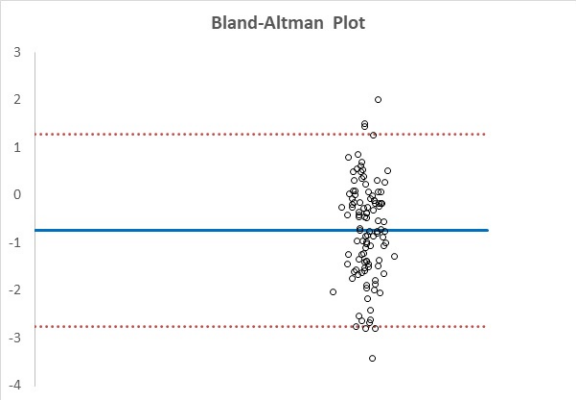

Fig-2: Agreement between Manual keratometry Vs IOL master for vertical corneal diopteric power.

Discussion

We used a manual keratometer that uses two keratometry mires along the main meridians of the cornea. The corneal power is determined using the reflection from these illuminated mires from the central 3.4 mm of the cornea. The device uses a refraction index of 1.3375. In the IOL Master, six-light spots are projected onto the cornea in a hexagonal pattern, and measurement is performed in a 2.3 mm radius [10].

Our study highlights that the IOL Master and manual keratometry not only show a significant correlation but also do not show significant differences. These findings indicate the interchangeability of the results of the IOL Master and keratometry. Despite the differences in the number of data points and the axis of imaging, the estimation of corneal power between devices yields similar values. This is of importance as routinely done procedures such as IOL power calculation, toric IOL power calculation and contact lens fitting procedures which use central corneal power, can be done using a manual keratometer which is cost-effective & available at most places. The limitation of the study being, small sample size & lack of comparison in refractive surgery, keratoconus & pathological corneal disease population.

Conclusion

A very good agreement was found between manual and IOL master based corneal power calculation, underlining the importance of cost-effective manual keratometry in routine cataract surgical procedures.

What does the study add to the existing knowledge?

The current study underlines the value of economics effective of manually performed keratometry in regular cataract surgical procedures.

Author's contribution

Dr. P. Sanjeeva Kumar: Concept, **Dr. T. Sreevathsala:** Manuscript preparation, **Dr. M. Tejaswini:** Study design, **Dr. Kavya Konda:** Statistical analysis

Reference

01. Shirayama M, Wang L, Weikert MP, Koch DD. Comparison of corneal powers obtained from 4 different devices. Am J Ophthalmol. 2009;148(4)528-535.
e1. doi: 10.1016/j.ajo.2009.04.028 [Crossref]

02. Read SA, Collins MJ, Iskander DR, Davis BA. Corneal topography with Scheimpflug imaging and videokeratography- Comparative study of normal eyes. J Cataract Refract Surg. 2009;35(6)1072-81.
doi: 10.1016/j.jcrs.2009.01.020 [Crossref]

03. Ale Magar JB. Comparison of the corneal curvatures obtained from three different keratometers. Nepal J Ophthalmol. 2013;5(1)9-15.
[Crossref]

04. Sverker Norby. Sources of error in intraocular lens power calculation. J Cataract Refract Surg. 2008;34(3)368-76.
[Crossref]

05. Visser N, Berendschot TT, Verbakel F, de Brabander J, Nuijts R M. Comparability and repeatability of corneal astigmatism measurements using different measurement technologies. J Cataract Refract Surg. 2012;38;1764-70.
[Crossref]

06. Razmju H, Rezaei L, Nasrollahi K, Fesharaki H, Attarzadeh H, Footami FJ. IOLMaster versus manual keratometry after photorefractive keratectomy. J Ophthalmic Vis Res. 2011;6;160-5.
[Crossref]

07. Schäfer S, Kürzinger G, Spraul CW, Kampmeier J. Comparative results of keratometry with three different keratometers after LASIK. Klin Monbl Augenheilkd. 2005;222;419–423.
[Crossref]

08. Savini G, Barboni P, Carbonelli M, Hoffer KJ. Accuracy of Scheimpflug corneal power measurements for intraocular lens power calculation. J Cataract Refract Surg. 2009;35;1193–1197.
[Crossref]

09. Chang M, Kang SY, Kim HM. Which keratometer is most reliable for correcting astigmatism with toric intraocular lenses?. Korean J Ophthalmol. 2012 Feb;26(1)10-4.
[Crossref]

10. Zahra Dehnavi, Mehdi Khabazkhoob, Ali Mirzajani, Mahmood Jabbarvand, Abbasali Yekta, Ebrahim Jafarzadehpur. Comparison of the Corneal Power Measurements with the TMS4-Topographer, Pentacam HR, IOL Master, and Javal Keratometer. Middle East Afr J Ophthalmol. 2015 Apr-Jun;22(2)233–237.
[Crossref]