

Comparing keratometry readings with manual separation of lids and wire speculum in children under general anesthesia

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Purpose: Keratometry (K) readings are crucial for intraocular lens power calculation in cataract surgery. In children who do not cooperate, the keratometry is done under general anesthesia with a handheld autokeratometer. However, there is little consensus regarding the method for the measurement of K readings. The lids can be separated either by fingers or a wire speculum may be placed to separate the lids for measurement. **Methods:** The children selected for the study were patients cooperative for keratometry reading. Nidek KM-500 handheld keratometer was used first in the awake period. Then under general anesthesia, readings were taken first by separating the lids manually with fingers and then after putting a wire speculum in both the eyes. **Results:** The average keratometry reading for participants in the OPD, anesthetized with lids manually opened and with lids separated with speculum was 44.7 ± 1.7 D, 44.4 ± 1.9 D, and 44.7 ± 1.7 D, respectively. **Conclusion:** No significant change was observed in keratometry values in children with manual separation of eyelids or with wire speculum.

Key words: Children, keratometry reading, supine position

Keratometry (K) is a critical measurement in cataract surgery because errors in measurements are matched 1:1 to refractive outcomes. The refractive power of cornea can be measured with keratometer and hence the method is called keratometry.^[1,2] Keratometry (K) is a critical measurement in cataract surgery because errors in measurements are matched 1:1 to refractive outcomes. If K is inaccurate, then there will be an unexpected refractive surprise post-operatively. Multiple options are available for clinical use for measuring the corneal power in dioptre (D), including manual (Bausch and Lomb), (Javal-Schiotz), automated (autokeratometers), optical biometers, and corneal topographers (Placido and Schiøtz imaging).^[3] While the child is under anesthesia, there is no consensus on how to separate the lids with speculum or with fingers and the difference between the two and with the normal position of the child if any. To compare the auto keratometer readings taken by separating the lids with fingers and with speculum.

Methods

A prospective study was done over 2 years at Baroda Children Eyecare and Squint Clinic, Vadodara, Gujarat. The study was approved by the institutional ethical committee and all children and the parents were informed that keratometry readings were being taken and written consent was taken for the same. Keratometry readings were taken with Nidek KM-500

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handheld keratometer first in the awake period. Then under general anesthesia readings were taken first by separating the lids manually with fingers and then after putting a wire speculum in both the eyes. All the patients undergoing this were routine strabismus patents being operated under general anesthesia [Fig. 1].

- Group A had measurement taken in awake period
- Group B had measurement taken with lids separated manually by examiner
- Group C had measurement taken after a speculum was placed.

The readings were recorded and compared. All the patients who were cooperative and had best-corrected visual acuity of 6/6 were included in the study. Children with poor fixation, corneal opacity or other corneal problems were not included in the study.

Statistical analysis

Normality was tested using the Shapiro-Wilk test. Normally distributed variables were expressed as means with standard deviation. ANOVA test was used to compare the average keratometry readings amongst the 3 groups. To know the agreement between the group A that is the OPD values were compared with intraop that is group B and group C using Blant Altman analysis [Figs. 2 and 3]. Further to this, interclass

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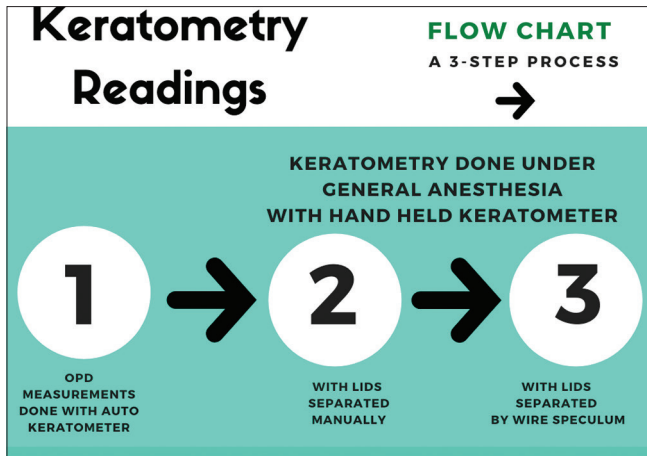


Figure 1: Flowchart of the various reading taken. First the reading was taken in OPD under awake state. Next the lids were separated manually in step 2 and readings were taken. As a third step, a wire speculum was placed and reading were taken again

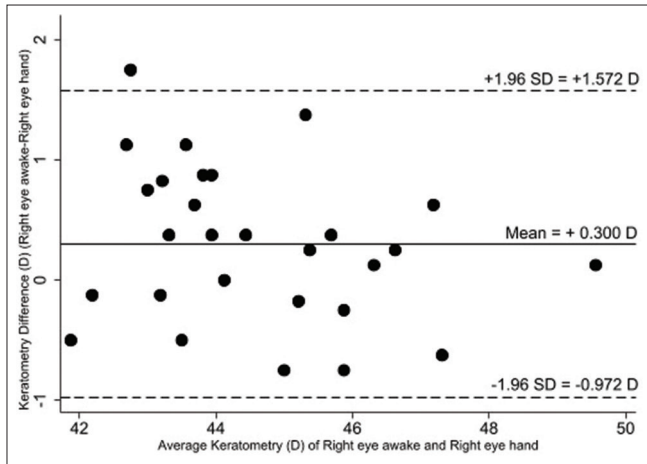


Figure 2: Blant Altman plot showing various reading and correlation between the group A (OPD) values and group B (reading taken while separating lids manually)

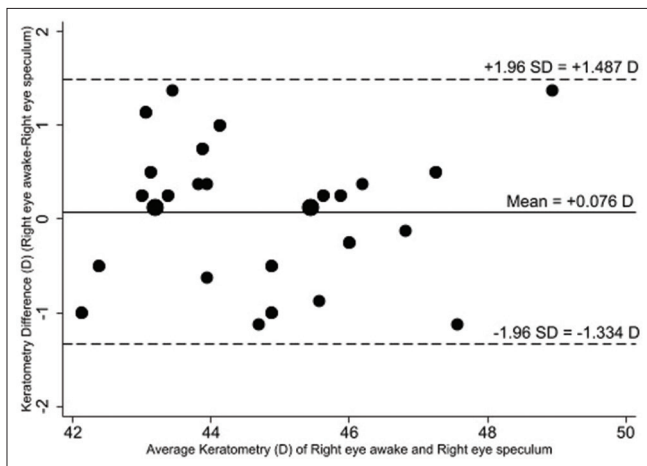


Figure 3: Blant Altman plot showing various reading and correlation between the group A (OPD) values and group C (reading under speculum)

correlation coefficients (ICC) were calculated which showed excellent correlation of both the methods with OPD values. An ICC value of 0.92 between group A and group B was found and 0.91 between group A and group C was found which shows excellent correlation.

Results

The mean age of the participants was 8.6 ± 4.6 years (range 5-16 years) and this included 15 females and 13 males. Twenty-eight eyes of 28 patients were included in the study. Only right eye was taken for comparison to avoid any selection bias. The average keratometry reading for participants in the normal position, with lids manually opened and with lid opened with speculum was 44.7 ± 1.7 D, 44.4 ± 1.9 D and 44.7 ± 1.7 D, respectively. The difference among the groups was not statistically significantly different ($P = 0.8$).

Discussion

The manual keratometer especially Baush and Lomb has remained almost similar since 1932.^[4] It is one of the most accepted and commonly used one in India in routine clinical practice. It helps in measuring the central 3 mm curvature of the cornea and the reading range from 36 D to 52 D.^[4] Since early 1980s, the automated keratometers were introduced and have gained widespread acceptance mainly due to the ease of use and reliability.^[3-5] The readings range from 34 D to 67 D. The manual keratometry has been the mainstay for measuring the K reading for adults. It requires patient’s cooperation and many children are very uncooperative for this procedure. The children, however, may not cooperate much with manual keratometers. In these young uncooperative children, keratometry needs to be done while the child is sleeping, under oral sedation or general anesthesia with the help of portable automated keratometer.^[3]

The advantage of autokeratometer is that it allows quicker evaluation. Kaushik *et al.* reported that the values measured with manual keratometry and with portable automated keratometer were similar and comparable.^[3] The study was done in Indian population. Although Chang *et al.* reported that manual keratometry was better for toric IOL, other methods were equally satisfactory.^[6] The study was mainly in adults and for assessing the results of toric IOL. Noonan *et al.*^[7] reported that portable handheld autokeratometer was quite useful and reliable in children for corneal astigmatism. Values are not influenced by skill of operating person and therefore inter observer variations are eliminated. Patient cooperation is better due to shorter duration and therefore autokeratometer is preferable in children.^[3,7,8] Manning *et al.* compared the accuracy of portable automated keratometry (PAK) with that of manual keratometry (MK) in measuring corneal power for intraocular lens calculations. They concluded that portable automated keratometry is a simple keratometric technique that appeared to be as accurate as but with less variability than manual keratometry in determining corneal power for cataract surgery.^[9] Kobashi *et al.* assessed the repeatability and agreement of corneal power, corneal astigmatism, axis location, and astigmatic vector component measurements using an autokeratometer and a corneal topographer in healthy subjects. The study concluded that both devices provided excellent repeatability and comparability of corneal powers and corneal astigmatism, suggesting they can be used interchangeably for measurement of these corneal variables in healthy eyes.^[10]

David *et al.* studied the corneal power measurements in fixating versus anesthetized nonfixating children using a Nidek KM-500 handheld keratometer and concluded that the Nidek KM-500 handheld keratometer provided reliable readings when used intraoperatively on anesthetized nonfixating children and required minimal time to perform.^[11] Similar study on reliability were done by Lam *et al.*^[12,13] They compared the effect of posture, artificial tears and also the position of the instrument holding.

David *et al.*^[11] has a population age similar to ours where children underwent the procedure and the children taken were for strabismus. Also they compared the readings between preoperative period when the child was fixing and under anesthesia when the eyes are not fixing. The results were comparable. The method of lid separation was not elaborated upon. We believe it is important because the pressure on the lids may change the K readings and the change may be different for a speculum than for fingers. We did a thorough literature search and could not find any study similar to ours. Though there is assumption that after separating the lids manually and after placing the speculum keratometry readings may change. This may be due to the uneven pressure of the fingers or the changes may be more with speculum due to the pressure of the speculum. Our study did not find any statistically significant change in the reading while using the two methods. The study has the important implication that keratometry readings under general anesthesia are similar to the ones done prior to anesthesia without any pressure of fingers or speculum.

Conclusion

We believe that manual separation or usage of a wire speculum gives comparable results for keratometric reading in children under general anesthesia.

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Conflicts of interest

There are no conflicts of interest.

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