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Comparison of Manual Keratometer with Autokeratometer

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The study was done to compare the corneal curvature readings obtained by Baush and Lomb manual keratometer with that of Nidek autokeratometer ARK-30 to find if either was superior to the other. Curvature of central 3mm corneal zone was measured in horizontal and vertical meridian with Bausch and Lomb manual keratometer and Nidek autokeratometer ARK-30 in 67 eyes of 52 patients between the age group 53 and 75. The readings were correlated and intraclass correlation (ICC) was calculated with 95% confidence limit. Mean +/- one Standard Deviation of differences between two readings (manual versus auto) was calculated. The autokeratometric values were predicted from manual readings using linear regression model. Vertical and horizontal readings obtained by two methods were comparable. Differences in values obtained by two methods were statistically insignificant. The corneal curvature readings obtained by Bausch and Lomb manual keratometer were comparable with that obtained by Nidek autokeratometer ARK-30.

Key words: Manual Keratometer, Autokeratometer.

Keratometry involves determination of the curvature of the anterior corneal surface (steepest and flattest meridians), expressed in dioptres or in mm of radius of curvature.[1] The anterior corneal surface is the main refracting surface of the eye. Its curvature is crucial to the refracting power and optical properties of the eye. Accurate measurement of the corneal curvature is important in ophthalmology and indeed essential in contact lens fitting. Aim of the study was to compare the corneal curvature readings obtained by Bausch and Lomb manual keratometer with that of Nidek autokeratometer ARK-30.[2]

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MATERIALS AND METHODS

The study was done by a single observer over a period of one year. Sixty seven eyes of fifty two randomly selected patients between the age group 53 to 75 years who presented to out patient department were included in study. Patients with corneal and conjunctival pathology, previous intraocular or extraocular surgery and contact lens users were excluded from study. Ocular examination included visual acuity measurement, slit lamp examination, IOP measurement, fundus examination and keratometry. Curvature of central 3mm corneal zone was measured in horizontal and vertical meridian with Bausch and Lomb keratometer (manually) and Nidek autokeratometer ARK-30.

Results of statistical analysis

Statistical methods

The keratometry readings were correlated

and intraclass correlation (ICC) was calculated with 95% confidence limit. Mean +- one SD calculated of differences between two readings (manual versus automated). The autokeratometry values were predicted from manual readings using linear regression model.

Participant profile

Sixty seven eyes of fifty two patients were examined. Age 62.8+- 5.4(Range 53 to 75 years) were included. Male to female ratio was 1:1.

Difference (Manual-Auto)= 0.16 ±1.02 (range:-2.25 to 3.75) ICC is 86.8% (78.6,91.9) Statistical significance

Table 1.

Ex. Observe Manual	Predicted Auto Auto	Error of model	
44.25	44.25	44.12	0.130

Predictability (Horizontal)
Horizontal K readings
Auto K (H) =[Manual K (H) x (0.856)] +6.237

Ability of model R^2=60.0%

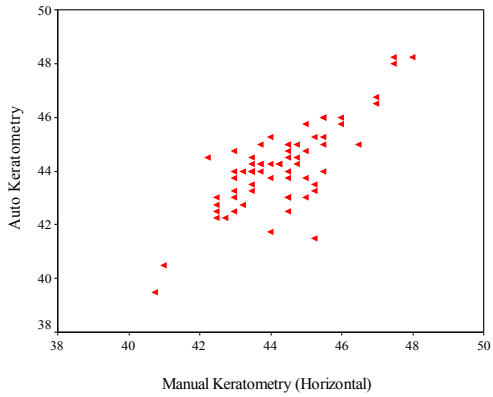

Fig. 1.

Table 2.

Ex. Observe Manual	Predicted Auto Auto	Error of model	
44.25	44.25	44.12	0.130

Predictability (Vertical)
Vertical K readings
Auto K (V) = [Manual K (H) x (0.761)] +11.941

Ability of model R^2=66.7%

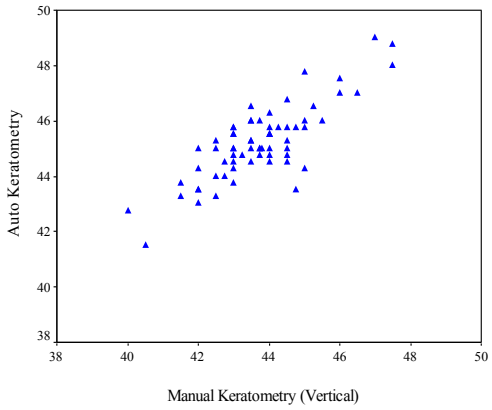

Fig. 2.

DISCUSSION

Vertical and horizontal readings obtained by manual and autokeratometer were comparable. Differences in values obtained by two methods were statistically insignificant. The advantage of autokeratometer is that it allows quicker evaluation. 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. The only disadvantage is cost of the machine. Hidenaga kabashi etal 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. However, disagreement in axis location between the 2 devices was not negligible in some eyes, especially in those with low astigmatism.[3] M.J.Giraldez etal compared three different keratometric methods normally used in contact lens fitting to assess the effect of

contact lenses on corneal curvature. Measurements were obtained from 100 normal eyes using a Javal ophthalmometer, an Nidek autokeratometer, and Corneal Analysis System (EyeSys) to compare the keratometric readings obtained by these three instruments. Using regression analysis and bias (the mean of the difference compared with zero), they found good agreement among the instruments. However, the 95% confidence limits showed a lack of agreement between them. Although the differences between instruments were clinically acceptable, relevant differences were found using the 95% confidence limits.[4]

Einat Shneor etal did clinical evaluation of the L80 videokeratographer (Visionix Luneau, Chartres, France) to assess its validity and repeatability compared with a traditional Bausch and Lomb (B & L) keratometer. Corneal curvature was found to be statistically different between the two instruments ($p<0.001$), with the L80 providing a slightly steeper bias of 0.05mm and 0.07mm for the horizontal and vertical meridians, respectively than the B & L keratometer. Intratest repeatability was the same for both instruments. Intertest repeatability was better for the L80 videokeratographer compared to the B & L keratometer and showed no significant difference between the two sessions.they concluded that L80 videokeratographer is a reliable objective instrument comparable to other autokeratometers which, in addition, combines many other useful clinical features. It provides steeper radii of curvature measurements than the B & L keratometer. An offset incorporated into the instrument could mitigate the difference between the two instruments and make them interchangeable.[5] Manning CA and Kloess PM 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.[6] Davies LN etal did clinical evaluation of the Shin-Nippon NVision-K 5001 (also branded as the Grand Seiko WR-5100K) autorefractor (Japan) to examine validity and repeatability compared with subjective refraction and Javal-Schiotz keratometry. Refractive error as measured by the NVision-K was found to be similar ($p = 0.67$) to subjective refraction (difference, 0.14 +/- 0.35 D). It was both accurate and repeatable over a wide prescription range (-8.25 to +7.25 D). Keratometry as measured by the NVision-K was found to be similar ($p > 0.50$) to the Javal-Schiotz technique in both the horizontal and vertical meridians (horizontal: difference, 0.02 +/- 0.09 mm; vertical: difference, 0.01 +/- 0.14 mm). There was minimal bias, and the results were repeatable (horizontal: intersession difference, 0.00 +/- 0.09 mm; vertical: intersession difference, -0.01 +/- 0.12 mm).[7] Thus we conclude that the corneal curvature readings obtained by Bausch and Lomb manual keratometer were comparable with that obtained by Nidek autokeratometer ARK-30 suggesting that they can be used interchangeably for measurement of corneal curvature.

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