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Peripheral keratometry - accuracy and reliability in comparison to a corneal topography system, for application in rigid contact lens fitting

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Abstract

Peripheral keratometry was once a widely used practice in optometry. The technique fell out of vogue in the mid-1960s when questions arose concerning its accuracy. In this project, the accuracy of peripheral keratometry was reevaluated on 162 normal non-contact lens-wearing eyes. The results obtained by a Reichert keratometer and a fabricated plastic peripheral fixation device were statistically compared to data obtained by the Humphreys MasterVue corneal keratoscopic mapping system. Patients were asked to fixate on a point 13mm from the center of a plastic disc overlaid onto the keratometer mire plate. The curvature value achieved with this fixation was then compared to the curvature value taken 3.0mm from the center of the corneal topographic map. Results show a high correlation(> 90%) between the mid-peripheral corneal curvature data obtained with the peripheral keratometry disc and data obtained by the corneal mapping system 3.0mm from center. Results from this study also indicate that the keratometer, when used with a peripheral fixation device, can yield data just as accurate as the corneal topography system (p-value > 0.05). Clinical application of this procedure could prove beneficial to the "general11 optometric practitioner who fits rigid contact lenses but may not be able to afford an expensive corneal mapping system.

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PERIPHERAL KERATOMETRY - ACCURACY AND RELIABILITY IN COMPARISON TO A CORNEAL TOPOGRAPHY SYSTEM, FOR APPLICATION IN RIGID CONTACT LENS FITTING

By

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&

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BIOGRAPHICAL PAGE

Rob Johnson graduated from Brigham Young University with a B.A. in Communication Studies. He is originally from Medford, Oregon. He has a wife and a daughter and hopes to practice optometry in the Pacific Northwest.

Jeff Gibbons graduated from Brigham Young University with a B.S. in Biology. He will practice optometry in the U.S. Air Force for at least three years to repay a scholarship commitment. Ultimately, Jeff would like to own a private practice in the west. His professional interests are in primary care, contact lenses, and hospital-based optometry.

ABSTRACT

Peripheral keratometry was once a widely used practice in optometry. The technique fell out of vogue in the mid-1960s when questions arose concerning its accuracy. In this project, the accuracy of peripheral keratometry was reevaluated on 162 normal non-contact lens-wearing eyes. The results obtained by a Reichert keratometer and a fabricated plastic peripheral fixation device were statistically compared to data obtained by the Humphreys MasterVue corneal keratoscopic mapping system. Patients were asked to fixate on a point 13mm from the center of a plastic disc overlaid onto the keratometer mire plate. The curvature value achieved with this fixation was then compared to the curvature value taken 3.0mm from the center of the corneal topographic map. Results show a high correlation (> 90%) between the mid-peripheral corneal curvature data obtained with the peripheral keratometry disc and data obtained by the corneal mapping system 3.0mm from center. Results from this study also indicate that the keratometer, when used with a peripheral fixation device, can yield data just as accurate as the corneal topography system (p-value > 0.05). Clinical application of this procedure could prove beneficial to the "general" optometric practitioner who fits rigid contact lenses but may not be able to afford an expensive corneal mapping system.

INTRODUCTION

The technique of peripheral keratometry was introduced in 1957 by May as a quantitative technique for the measurement of the midperipheral corneal curvature.[1] After central keratometry measurements were taken, the patient was instructed to direct their gaze to eccentric fixation points on the mire illumination plate of the keratometer. A midperipheral curvature value was then measured.

Although this technique gained significant clinical acceptance in the early 1960s, its acceptance was relatively short-lived, as significant criticisms of its accuracy arose.[2] These criticisms were primarily theoretical, based on concern regarding inherent measurement errors of the keratometer,[3] which determines the corneal curvature as a mean of two points 1.5mm on each side of the central corneal. This error was believed to be compounded by the natural asphericity of the peripheral cornea, which causes larger measurement errors when the mean of the two eccentric points is used to calculate the curvature. It is also significant that the original peripheral keratometry technique used eccentric fixation of 20 to 25 degrees, which gave measurements far beyond the midperipheral cornea.

The presence of a midperipheral bearing zone along the horizontal meridian 3.0mm to 4.0mm from the center of the cornea has been asserted to be a critical factor in fitting rigid contact lenses. Although computer-assisted corneal topography can determine this measurement, the instrumentation can be very expensive[4]. This has rekindled an interest in peripheral keratometry as a clinically useful and affordable technique.[5] In 1996, Caroline et al. developed a peripheral fixation device with fixation points 13.0, 14.0, 15.0, and 16.0mm from the center of the keratometer's illumination mire plate and compared measurements taken at these positions to measurements taken 3.0mm midperipherally on a computerized corneal map. A significant correlation was reported between the peripheral keratometry readings with the fixation device 14.0mm from center and the respective measurements from the corneal map.

Tennen, Keates, and Montoya determined in 1995 that keratometers and corneal topographers display no statistically significant difference in reliability when compared to the "gold standard" Javal-Schiotz keratometer.[6] However, they compared the instruments' readings only over the central 3.0mm of the cornea, not along the midperipheral bearing zone. Other research projects comparing the two devices also failed to consider the accuracy in the midperiphery.[7] Davis and Dresner in 1991 compared the two devices and found the keratometer to be statistically more precise and accurate for steeper surfaces (>43.00 diopters) than the topographer,[8] again using only central curvature values.

Many clinicians now routinely use a videokeratoscope with computerized corneal mapping software, simply referred to as a corneal topographer, in their contact lens fittings.[9] The benefit of these devices in the treatment and management of refractive surgeries and corneal diseases/dystrophies,[10] such as keratoconus, will not be debated in this paper. However, some researchers have questioned these devices' accuracy. Douthwaite stated, "Although the videokeratoscope may be useful in comparative studies of the cornea, there must be some doubt about the absolute values displayed. The disagreement is sufficiently large to suggest that the instrument may not be accurate enough for contact lens fitting purposes."[11]

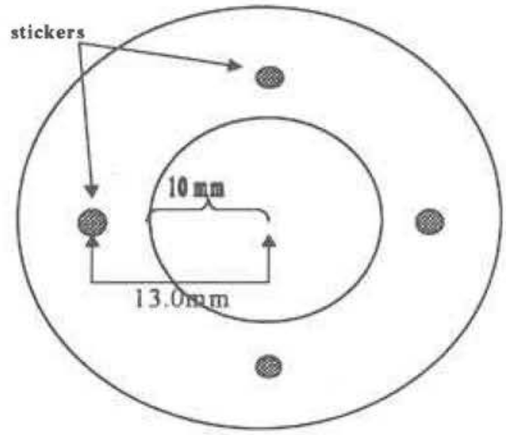
Several studies have investigated the accuracy of corneal topographer, finding them comparable to keratometers.[12] One study found the topographic data reliable in repeatability tests over the central cornea, but less so toward the periphery.[13] Szczothke et al. compared the two devices in the application of rigid contact lens fitting. [14] Both the keratometer and topographer showed no significant difference for base curve. However, over one-half of the patients required one to three parameter changes to get the lens to fit correctly. The researchers called the suggested base curve data provided by the topographer "clinically unacceptable." Unfortunately, they too compared the devices and fit the contact using solely the central keratometry readings.

The purpose of this study was to determine the accuracy and usefulness of the peripheral keratometry technique to an industry standard computer-assisted corneal topographer, the Humphreys MasterVue System.

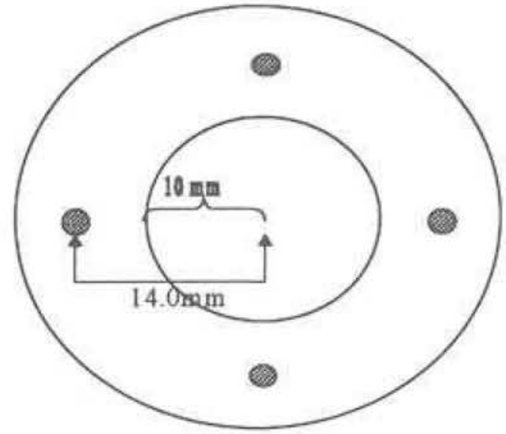
METHODS

Subjects for this study were drawn from the student body at Pacific University College of Optometry. Thirty-seven subjects (ten in the initial phase and twenty-seven in the final phase) between the ages of twenty-two and forty-five met the criteria for inclusion in this study. All regular full-time contact lens wearers were excluded from this study, as were those with any history of corneal disease, scarring, or dry eye. Each subject was informed of the purpose of this study and asked to sign an informed consent form. All equipment and materials were provided by Pacific University College of Optometry and Beta Sigma Kappa, the study sponsor.

The instrumentation used during both phases of the study were a Reichert keratometer, a Humphreys MasterVue corneal topography system, and a standard calibration contactometer. The peripheral fixation device consisted of a manufactured clear plastic disc, fit to the keratometer's illumination mire plate. Two discs were used. On each disc four yellow stickers, approximately 2.0mm in width, were placed at right angles to each other. On one disc, the fixation dots were placed 3.0mm from the edge of the 20.0mm diameter hollow view port, and 2.0mm from the edge for the other disc. A distance of 3.0mm was measured from the edge of the hollow view port of the first disc and a 1mm diameter red mark was made on the yellow sticker as the fixation point, giving 13.0mm of eccentricity from the center of the hollow view port [Picture 1]. On the second disc, a distance of 4.0mm was measured from the edge of the view port and again a red mark made in order to give 14.0mm of eccentric fixation [Picture 2].



[Picture 1 – 13.0mm disc with stickers]



[Picture 2 – 14.0mm disc with stickers]

The first phase of the study was to determine which of these two fixation distances correlated to the corneal topographer's measurement of corneal curvature at 3.0mm temporal from the corneal apex. Each instrument was calibrated and corneal maps were created for the right eye of each of the ten subjects. The keratometry measurements were then taken centrally and temporally with the 13.0mm and 14.0mm peripheral fixation devices on each subject's right eye. The temporal keratometry readings for each disc were compared to the measurement of corneal curvature 3.0mm temporally with the corneal topographer. Statistical analysis showed that the 13.0mm disc provided better correlation than did the 14.0mm disc.

First Phase Raw Data

Subject #	K value taken at 3.0mm eccentricity	K value taken at 4.0mm eccentricity	Topography value taken at 3.0mm from central cornea
1	42.25	42.25	42.50
2	43.00	43.00	43.20
3	45.00	44.67	45.00
4	43.25	42.75	44.10
5	43.37	43.50	43.60
6	43.37	43.37	44.10
7	43.75	43.75	43.60
8	44.00	44.00	43.90
9	41.25	41.12	41.40
10	42.87	42.62	42.80

[Table 1]

Statistical Comparison of 13.0mm and 14.0mm discs

	Mean Difference	t-value	P-value
3.0mm K value vs. Topography value	-0.209 D	-1.950	0.0830
4.0mm K value vs. Topography value	-0.317 D	-2.296	0.0473

[Table 2]

This data shows that the 13.0mm from center fixation disc was more statistically comparable to the topagraphy value, taken 3.0mm from the central cornea, than was the 14.0mm disc. This data agrees with an earlier performed experiment at Pacific University by Babcock et al.[15]

The second phase of the study involved the use of the 13.0mm disc, to determine the accuracy of the peripheral fixation device when compared to the corneal topographer. Both instruments were calibrated at the beginning of each session and again at the two-hour mark of each of two four-hour sessions. Each of the twenty-seven subjects had both their right and left eyes mapped with the corneal topographer, after which keratometry readings were taken centrally. After the central readings were taken, the examiner instructed each patient to fixate the red dot on the yellow sticker nearest the subject's nose, followed by patient fixation of the red dot inferiorly and superiorly, rendering peripheral measurements of the temporal, superior, and inferior cornea, respectively. Keratometry measurements were recorded to the nearest 0.12 D in each fixation position. Measurements of the nasal cornea were not done due to alignment problems as discussed by Caroline et al.[5] Keratometry measurements from each of the three peripheral fixation points were then compared statistically to the respective topography measurements taken 3.0mm from the geographic center to determine their correlation level and statistical difference.

RESULTS AND DISCUSSION

Total Experimental Data Obtained

Patient	OD/OS	Horiz. Central K	Vert. Central K	Temp. K	Temp. Topog.	Dx from Apex	Super. K	Super. Topog	Dx from Apex	Infer. K	Infer. Topog	Dx from Apex
26 yo WM	OD	43.75	44.62	43.63	43.80	3.07	44.25	44.60	3.11	44.25	44.50	3.02
26 yo WM	OS	44.13	44.75	43.38	43.70	3.06	44.37	44.60	2.93	44.00	44.30	3.03
27 yo WM	OD	43.13	43.00	42.63	42.90	3.06	42.87	42.80	3.08	42.87	43.40	2.92
27 yo WM	OS	43.00	42.87	42.63	42.90	2.96	42.37	42.80	3.08	43.25	43.80	3.07
24 yo WF	OD	43.13	43.00	42.63	42.80	3.07	42.50	43.00	2.95	42.75	42.80	2.95
24 yo WF	OS	43.13	43.37	42.88	42.80	2.97	42.75	43.20	2.97	43.00	43.30	2.94
28 yo WF	OD	43.88	43.62	43.00	42.70	2.96	42.25	42.60	3.02	43.37	43.40	2.92
28 yo WF	OS	43.88	44.25	43.25	42.80	2.98	42.50	42.20	3.02	44.25	44.00	3.07
25 yo WM	OD	44.88	44.50	44.50	44.50	2.99	44.12	44.30	2.91	44.75	44.60	3.01
25 yo WM	OS	45.00	44.87	44.50	45.10	3.10	44.25	44.40	2.90	44.25	43.80	3.06
31 yo WM	OD	42.75	42.75	42.13	42.30	2.99	42.75	42.70	3.08	41.87	43.10	2.94
31 yo WM	OS	42.88	43.25	42.75	42.90	2.96	43.00	42.90	3.08	43.25	43.40	2.93
25 yo WM	OD	40.38	40.25	39.88	39.70	3.01	39.50	39.50	3.07	40.75	40.50	2.95
25 yo WM	OS	40.50	40.25	40.00	40.20	2.99	39.62	39.80	3.02	41.00	41.00	2.93
27 yo WM	OD	44.37	44.00	43.75	43.60	3.07	43.00	43.30	2.93	44.62	44.60	3.01
27 yo WM	OS	43.50	44.12	43.25	44.30	3.06	43.12	43.00	2.97	44.75	44.70	3.03
27 yo WM	OD	44.62	44.87	44.62	44.50	3.03	44.62	44.90	3.00	45.12	45.00	2.99
27 yo WM	OS	45.25	45.37	44.62	45.30	2.97	44.62	45.20	2.98	45.50	45.70	2.95
30 yo WM	OD	44.00	42.75	44.12	43.70	2.98	42.37	42.80	2.98	43.12	43.60	2.91
30 yo WM	OS	43.25	44.37	42.87	42.80	2.96	44.25	44.00	3.01	44.12	43.90	3.06
30 yo WM	OD	40.87	41.00	40.50	40.70	2.96	40.50	40.50	2.90	41.12	41.10	2.93
30 yo WM	OS	41.00	41.62	40.50	40.70	2.94	40.12	40.30	3.06	41.62	41.30	3.07
30 yo WF	OD	44.87	44.50	44.62	44.90	3.00	43.75	43.60	2.91	44.62	44.80	3.00
30 yo WF	OS	44.75	44.50	44.25	44.30	3.09	44.25	43.40	2.92	44.50	44.40	3.03
29 yo WF	OD	42.37	43.87	41.62	42.20	3.02	43.50	43.60	3.06	43.50	43.60	2.93
29 yo WF	OS	42.62	43.75	42.12	41.80	3.03	43.75	43.20	2.91	43.50	43.40	2.92
27 yo WM	OD	44.00	43.75	43.50	43.50	2.91	43.63	43.00	2.95	43.88	44.10	3.03
27 yo WM	OS	42.63	43.63	42.63	42.10	3.05	41.75	41.90	2.96	44.88	44.70	3.00
38 yo WM	OD	42.75	42.75	43.00	43.10	2.95	42.88	42.90	2.96	41.88	42.10	3.01
38 yo WM	OS	42.00	42.88	42.63	43.50	2.93	43.38	43.20	2.95	41.88	42.30	3.00
34 yo WF	OD	41.25	42.13	41.25	41.20	2.94	41.88	41.20	3.04	41.38	41.70	3.02
34 yo WF	OS	40.75	42.63	40.63	40.70	2.95	41.38	41.00	2.96	42.75	42.60	2.99
45 yo WF	OD	42.25	42.13	42.00	42.30	3.10	43.00	42.40	3.08	41.88	42.00	3.01
45 yo WF	OS	42.63	42.75	42.38	42.00	3.04	42.25	41.80	3.05	42.38	41.90	3.04
22 yo WF	OD	44.50	45.38	43.25	43.80	2.91	45.13	44.90	2.97	45.25	45.30	2.97
22 yo WF	OS	45.13	45.13	44.38	44.10	3.04	45.75	45.50	2.99	45.50	45.20	2.97
26 yo WM	OD	42.50	43.13	42.25	42.00	3.02	43.13	42.60	2.92	42.50	42.10	3.01
27 yo WM	OD	44.13	45.63	44.00	43.70	2.90	44.75	45.00	2.98	45.00	44.90	2.98
27 yo WM	OD	44.88	46.25	44.00	44.10	3.04	45.50	44.80	3.04	46.00	45.50	2.95
27 yo WM	OS	45.13	45.63	44.38	44.60	3.01	44.88	44.80	3.06	45.75	45.50	2.96
24 yo WM	OD	42.88	42.38	42.63	42.50	2.99	42.50	42.20	2.99	42.38	42.00	3.01
24 yo WM	OS	42.63	42.25	42.50	42.60	2.99	42.25	42.20	3.01	42.38	42.40	3.00
27 yo AM	OD	44.75	46.13	45.13	44.90	2.99	46.75	46.90	3.02	46.25	46.20	2.91
27 yo AM	OS	44.75	46.25	45.13	44.90	2.98	46.88	46.70	3.00	45.63	45.90	2.92
23 yo WF	OD	44.50	45.25	44.50	44.50	3.01	44.38	44.20	3.05	45.38	45.40	2.95
23 yo WF	OS	44.38	45.25	44.50	44.50	3.02	44.25	43.90	2.89	45.25	45.40	2.96
32 yo WF	OD	43.38	43.88	43.13	43.00	2.96	42.88	42.90	2.98	43.50	43.50	2.93
32 yo WF	OS	43.00	44.13	42.63	42.50	2.99	41.50	42.20	2.90	43.88	44.00	3.06
23 yo WF	OD	43.38	43.38	43.25	43.00	2.95	42.50	42.20	2.96	43.63	43.60	3.07
23 yo WF	OS	43.88	43.13	43.38	43.60	3.08	42.13	42.20	3.00	43.38	43.70	3.07
24 yo WM	OD	41.88	43.13	41.63	41.60	3.04	41.63	41.90	3.08	43.13	43.20	2.94
24 yo WM	OS	41.13	42.63	41.63	41.70	3.04	41.88	41.30	3.07	43.63	43.40	2.93
25 yo WM	OD	44.63	45.13	44.25	44.30	3.04	44.75	44.60	2.92	45.13	44.90	3.00
25 yo WM	OS	44.38	45.63	43.88	44.20	3.06	44.50	44.40	2.95	44.38	44.40	3.04
	MEAN	43.3328	43.7485	43.0200	43.0815	3.0039	43.2041	43.1481	2.9922	43.6767	43.7019	2.9870

[Table 3]

All experimental recordings are listed in Table 3. Included in this table are the keratometry readings, both central and midperipheral, as well as the respective midperipheral corneal curvature readings taken from the corneal topographer. A discussion of important points of the data follows.

A paired t-test was calculated on the data obtained from the temporal peripheral keratometry readings, with patient fixating 13.0mm from the center of the keratometer's mires, and the temporal topography readings, taken at approximately 3.0mm from the center of the cornea. T-tests were also calculated for the superior and inferior cornea readings.

T-test Data

	Mean Difference	**t-Value**	**P-Value**
Temp. Topog. vs. Temp. K	0.062 D	1.423	0.1607
Super. Topog. vs. Super. K	-0.056 D	-1.154	0.2537
Infer. Topog. vs. Infer. K	0.025 D	0.608	0.5455

[Table 4]

The above t-tests were run on a 95% confidence interval. These results indicate (the p-value being greater than 0.05 in every instance) that there was no significant difference between the midperipheral measurements obtained with the two instruments. Had the p-value been 0.05 or less, then the hypothesis (both instruments obtain different readings) would have been true. Since it is not below 0.05, the null hypothesis is true: there is no difference between the two instruments' data. The mean difference shows the mean curvature reading obtained with the keratometer for all subjects was within one-tenth of a diopter of the mean obtained with the corneal topographer.

Other analyses of the data, such as descriptive statistics, correlation, and scattergram plots, were performed and are listed below in Tables 5, 6, and 7.

Descriptive Statistics

	Count	Mean	Std. Dev.	Std. Err.	Min.	Max.
Temp. Topog	54	43.081	1.324	0.180	39.70	45.30
Temp. K	54	43.019	1.296	0.176	39.88	45.13
Sup. Topog	54	43.148	1.560	0.212	39.50	46.90
Sup. K	54	43.204	1.570	0.214	39.50	46.88
Inf. Topog	54	43.702	1.367	0.186	40.50	46.20
Inf. K	54	43.677	1.400	0.191	40.75	46.25

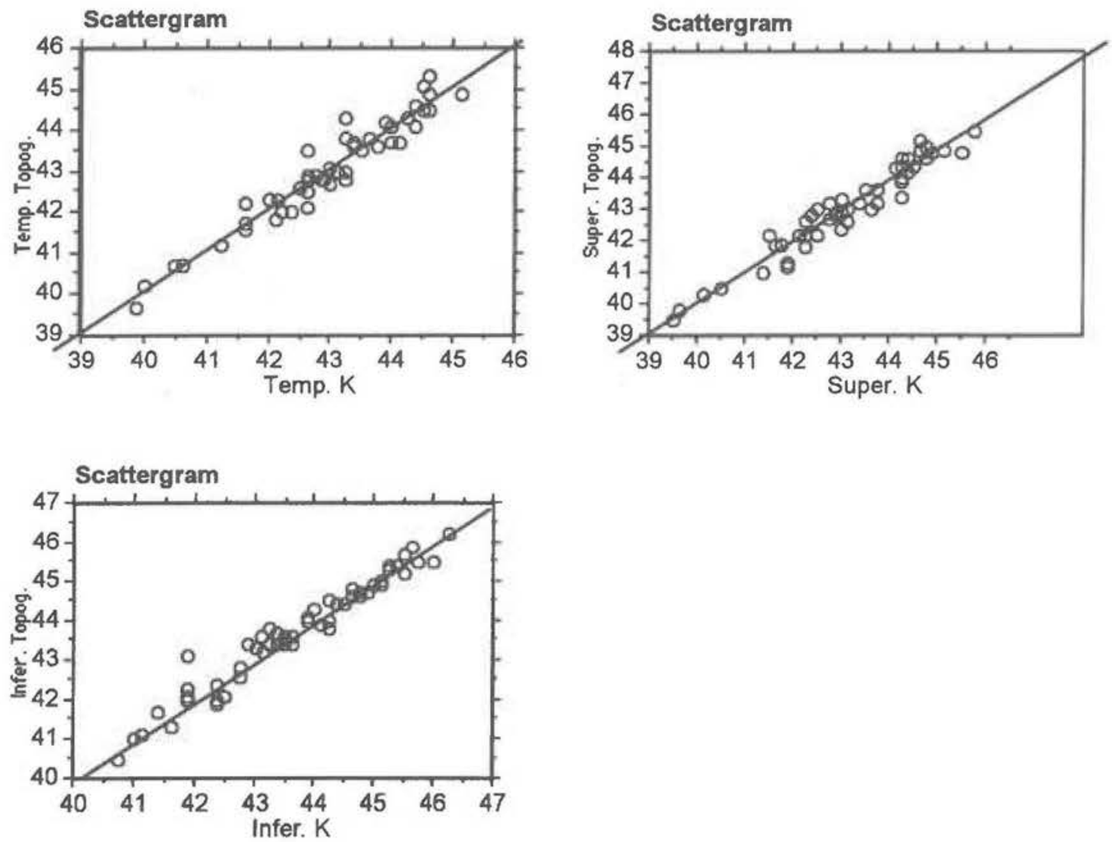
[Table 5]

Correlation Data

	Correlation	Z-value	P-value
Temp. Topog. & Temp K	0.970	14.937	<0.0001
Sup. Topog. & Sup. K	0.974	15.476	<0.0001
Inf. Topog. & Inf. K	0.976	15.766	<0.0001

[Table 6]

<u>Scatterplot Data</u>



[Table 7]

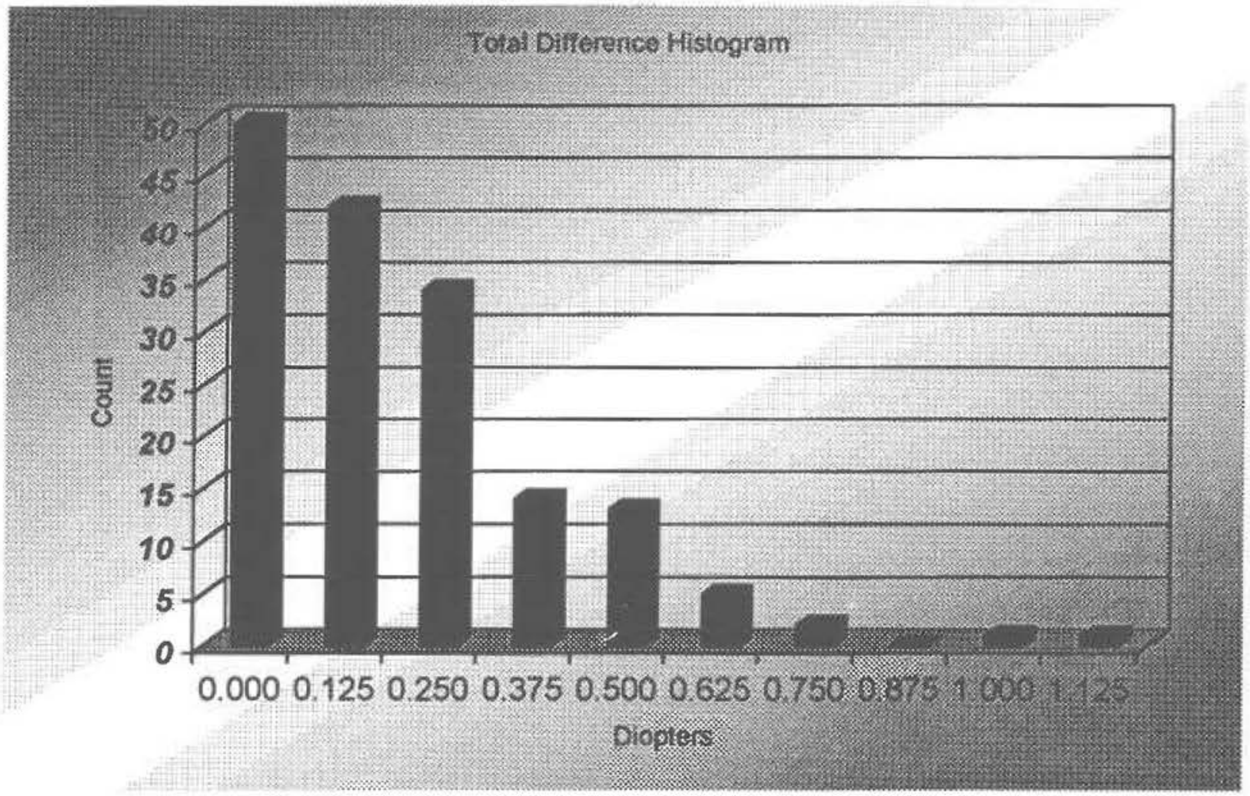
The scatterplot graphs in Table 7 show actual data points obtained. The slope of the line drawn through these points would represent the correlation figure mentioned above. A perfect correlation between two sets of data points would be 1.00 (being represented on the scatterplot by a line of points with a 45 degree slope). Data obtained in this study show a correlation very near 1.000 (temporal being 0.970, superior at 0.974, and inferior at 0.976) and a slope of approximately 45 degrees.

It is also beneficial to look at a frequency histogram of the amount of difference between the two instruments' measurements. It has been reported that both a keratometer and corneal topographer are accurate within +/- 0.25 D.[16, 17] Many practitioners consider an accuracy of +/- 0.50 D to be clinically significant. In this study, the average difference between instruments, for all measurements, was 0.253 D, well within the clinically significant figure and right at the reported optimum accuracy levels for the two instruments. The frequency distribution and histogram in Table 6 show the amount of error and occurrence of error between the keratometer's and the corneal topographer's readings.

Frequency Distribution for Differences in Measurements

From (>)	To (≤)	Amount	Percent	Total Amt.	Total %
0.000 D	0.125 D	50	30.864%	50	30.864%
0.125 D	0.250 D	42	25.926%	92	56.790%
0.250 D	0.375 D	34	20.988%	126	77.778%
0.375 D	0.500 D	14	8.642%	140	86.420%
0.500 D	0.625 D	13	8.025%	153	94.444%
0.625 D	0.750 D	5	3.086%	158	97.531%
0.750 D	0.875 D	2	1.235%	160	98.765%
0.875 D	1.000 D	0	0%	160	98.765%
1.000 D	1.125 D	1	0.617%	161	99.383%
1.125 D	1.250 D	1	0.617%	162	100.000%
	Total	162	100%	162	100%

[Table 8]



[Table 9]

Descriptive Statistics of Differences in Measurements

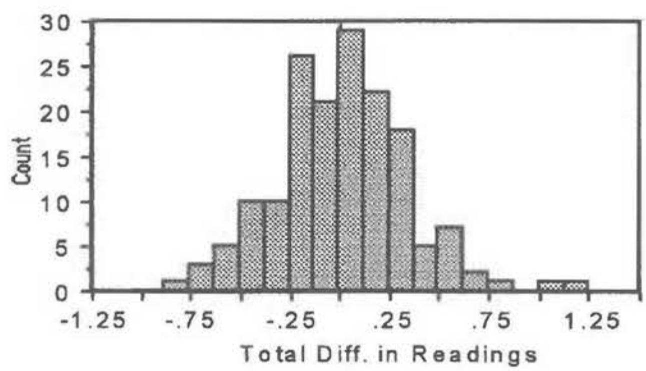
Mean	.253
Std. Dev.	.211
Std. Error	.017
Count	162
Minimum	0.000
Maximum	1.230
# Missing	0

[Table 10]

The above tables indicate that of the 162 measurements that were made (54 eyes with three peripheral curvature readings each), 86.42% fell within the clinically significant figure of 0.50 diopter. The range in error was between no difference (0.00 D) and 1.23 D. Most data points were within 0.75 D (97.53%), and the rest (four eyes) showed errors greater than this. Errors of this magnitude could be attributed to inaccurate fixation on the part of the patient when seated in the keratometer, inaccurate instruction set given by the experimenter as to which fixation target to look at, inaccurate technique in aligning the mires and reading the drum values, etc. However, these errors occurred very infrequently, and, for the most part, all the data shows a strong correlation between the measurements obtained with each instrument. Below is a histogram and graph for all errors in measurements.

<u>Frequency Distribution and Histogram of Differences</u>

from(≥)	to (<)	count	percent
-1.000	-0.875	0	0.000
-0.875	-0.750	1	0.617
-0.750	-0.625	3	1.852
-0.625	-0.500	5	3.086
-0.500	-0.375	10	6.173
-0.375	-0.250	10	6.173
-0.250	-0.125	26	16.049
-0.125	0.000	21	12.963
0.000	0.125	29	17.901
0.125	0.250	22	13.580
0.250	0.375	18	11.111
0.375	0.500	5	3.086
0.500	0.625	7	4.321
0.625	0.750	2	1.235
0.750	0.875	1	0.617
0.875	1.000	0	0.000
1.000	1.125	1	0.617
1.125	1.250	1	0.617
	Total	162	100.000



[Tables 11 and 12]

CONCLUSION

The collected data suggest a high correlation and accuracy between midperipheral corneal curvature measurements taken with both a standard keratometer (with the peripheral fixation device) and an industry standard, corneal topographer. Our findings suggest that the fixation device could be useful in the fitting of rigid contact lenses. Most practitioners fit these lenses either from central keratometry readings or from midperipheral curvature readings from a corneal topographic map, usually 3.0mm from the corneal apex. Optometric practitioners using a keratometer with a peripheral fixation device could reliably expect their measurements to be within 0.50 D of a corneal topographer's estimation for these peripheral curvature readings.

In addition, the availability and cost of a keratometer make it a more ideal tool for the "ordinary" practitioner. A new corneal topographic system, depending on computer hardware and software that one purchases with it, can cost between $10,000 and $20,000.[4] A keratometer is a standard piece of equipment in every optometric practice, and the cost of a peripheral fixation device is negligible (approximately $10).

While it is beyond the scope of this study to critique the advantages[18] and disadvantages of corneal topography systems, they are an important diagnostic and therapeutic tool in the management of many corneal diseases and dystrophies. However, it may be beyond the means of every optometrist to purchase one, and possibly even beyond every optometrist's scope of practice. For the "common" practitioner who fits contact lenses regularly, the keratometer and peripheral fixation device may be a more economic, and reliably accurate, way to go.

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