5-1977

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Abstract

Fifteen patients were fit with the Dura-Soft™ (Phemecol) hydrophilic astigmatic contact lenses. Due to length of time to receive the lenses only three patients were considered full time wearers at the time of publication. One patient was taken off the study due to physiological incompatibility to the lens. Of the thirty lenses ordered, sixteen were reordered. Stx were changed for spherical power, three for cylinder power, three for cylinder axis, three were ordered flatter than verified basecurve, twelve were ordered steeper than verified basecurve, and for twelve lenses the prism component was changed. Many of the new lenses ordered required more than one lens variable changed.

Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

James E. Peterson

Subject Categories

Optometry

A CLINICAL EVALUATION OF THE WESLEY - JESSEN ASTIGMATIC HYDROPHILIC DURA - SOFT TM. CONTACT LENS (Phemecol)

A THESIS PRESENTED TO

THE FACULTY OF THE COLLEGE OF OPTOMETRY

PACIFIC UNIVERSITY

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS OF THE

DEGREE DOCTOR OF OPTOMETRY

MAY 1977

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OK 3/1/77
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ABSTRACT

Fifteen patients were fit with the Dura-Soft™ (Phemecol) hydrophilic astigmatic contact lenses. Due to length of time to receive the lenses only three patients were considered full time wearers at the time of publication.

One patient was taken off the study due to physiological incompatibility to the lens. Of the thirty lenses ordered, sixteen were reordered. Six were changed for spherical power, three for cylinder power, three for cylinder axis, three were ordered flatter than verified basecurve, twelve were ordered steeper than verified basecurve, and for twelve lenses the prism component was changed. Many of the new lenses ordered required more than one lens variable changed.

ACKNOWLEDGEMENTS

We would like to thank James E. Peterson, O.D. and Steven Dippel, O.D. for their help and clinical supervision during the fitting and follow-up of these patients. Also, a thank you to Christian Johansen for his work verifying the basecurves of the lenses during the course of our study.

Finally, we would like to convey a very special thanks to Wesley-Jessen, Inc. for supplying the lenses that made this study possible.

A CLINICAL EVALUATION OF THE WESLEY - JESSEN ASTIGMATIC HYDROPHILIC DURA - SOFT ™ CONTACT LENS (Phemecol)

I. INTRODUCTION

In the past there have been many unsuccessful or rejected candidates for contact lens wear due to a decreased visual acuity caused by residual astigmatism (cylinder refraction through a spherical hydrophilic contact lens). Since the technology is now available to produce a soft lens to correct this residual astigmatism, we feel a hydrophilic cylinder lens will solve many of the problems of spherical contact lens wearers. We realize that these lenses may, in addition to solving some problems, create new unique problems. These in time will have to be resolved by experimentation and experience.

A review of the literature shows that there has been only one published methodology for fitting Dura-Soft (Phemecol) Astigmatic Hydrophilic contact lenses.[6] We choose to use the combination of prism ballast and truncation as the means of stablization rather than the "Dynamic Stablization" method employed by in the WEICON - T Hydrophilic lens (Fanti)[4] or the use of a double truncation advocated by Bayshore.[1]

Because of the characteristics of the Dura-Soft (Phemecol) lens, we do <u>not</u> believe that power change from warpage of the lens due to corneal cylinder will be a factor in determining the final cylinder and sphere power to be ordered.

This study will also show whether it is possible to use a spherical hydrophilic lens to approximate the fitting characteristics of a toric lens. Burnett Hodd [2] states that this is not possible because of changes in fitting characteristics due to the front surface cylinder of the lenses.

Our premise is that an initial lens fit can be determined by a trial lens set consisting of spherical, truncated, prism ballast lenses. We will describe to the clinical practitioner a procedure for selecting the initial fit lens. Included will be a practical method for determining the axis and power of the cylindrical component.

II. METHODOLOGY

1. MATERIALS

Clinical: Ten trial lenses - prism ballast - single truncated

Trial Lens Set

10 lenses	
Base Curves	7.8 - 8.6 mm
Diameter	12.8/11.8 mm
Power	-3.00
Prism	3/4 Δ
Truncation	Single Truncation 90° to base apex line

Aseptor units, cases, solutions already available from ongoing Dura-Soft study.

Patient Supplies: Aseptor, solutions, etc. will be purchased by the patient.

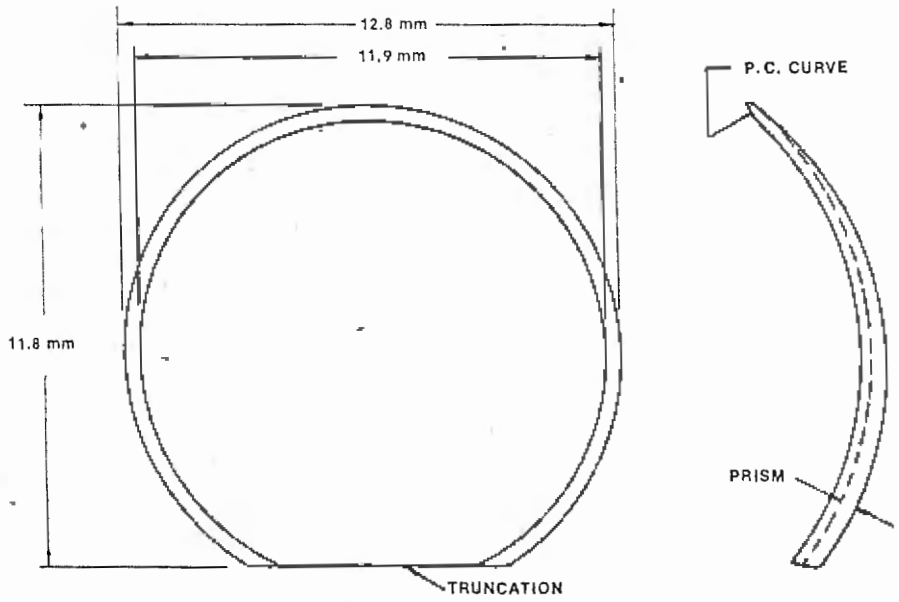
All lenses will be obtained from Wesley-Jessen in the same manner as lenses for the present Dura-Soft study. Wesley-Jessen has supplied the trial lens set for the study.

2. PROCEDURE:

Population

Note: Patient must sign two informed consent forms prior to start of investigation

A. Maximum 30 patients.
B. Residual cylinder 0.75 D or more.
C. Maximum corneal cylinder 6.00 D.
D. Age - able to handle lens successfully.
E. Does not have to be a previous contact lens wearer.
F. No ocular diseases or inflammations.
G. No serious binocular dysfunctions.
H. Sufficient tear break up time (15 seconds).



Water Content in Normal Saline	30%
Linear Expansion Coefficient in Normal Saline	14%
Shore A Hardness	31
Specific Gravity 25°/25°	1.18
Refractive Index	1.453
Visible Light Transmission	90% min.
Tensile Strength	8.3 kg/cm²
Modulus of Elasticity	1.54 kg/cm²
Elongation at Break	486%
Folding endurance, 1 kg. load	328 cycles
Burst Strength Tensile	85 psi
Burst Pressure	6-8 psi
Lens Flex, by hand	1000 cycles
Oxygen Permeability	$3 \times 10^{-10} \frac{cm^2 ml\ O_2}{sec\ ml\ cm\ Hg}$

FIG. 1 PHYSICAL PROPERTIES

I. Refractive error, plano to -10.00 D, plano to +5.00 D. sphere.
J. Satisfactory patient motivation.
K. Improvement in visual acuity must be obtained with astigmatic contact lenses over spherical soft lenses.
L. No evidence of lid infection.
M. No structural lid abnormality.
N. No conjunctivial abnormality or infection.
O. A cornea which is clear with no edema, staining, scars, vascularization or abnormal opacities all as observed by slit lamp.
P. No iritis.
Q. No ocular disease present.

3. FITTING

A. Complete 21 point analytical exam.
B. Photoelectrokeratoscopy to be used as a before and after comparison of corneal topography.
C. Objective fitting characteristics as determined by trial lens fit
   a.) Movement - at least 1 mm
   b.) Centration - symetrical about the limbus
   c.) Rotation - less than 5°
   d.) Lens lag - 2mm on upward gaze
   e.) Mire images with and without lenses (Distortion D1, 2, 3, and 4)
   f.) Over refraction
   g.) Retinoscopic images
   h.) Slit lamp examination
   i.) Refraction and keratometer readings without lenses
D. Ordering of proper cylinder and spherical powers once a satisfactory diagnostic lens is found.
E. Patient instruction in handling and care of the lens and initial dispensing.
F. Commence with four hours wear, alternated with one hour off, increasing to six hours minimum continuous wear by approximately the end of one week after the initial fitting. By approximately the end of the second week after fitting, increase the eight hours minimum continuous wear. By approximately the end of one month after the initial fitting, the eye

F. (continued)
must accomodate at least twelve hours or more daily wear. Thereafter, the lenses are generally to be worn approximately 12 hours continuously each day. Removal of the lens for cleaning is permissable provided the lens is immediately replaced after cleaning.

G. Subjective fitting characteristics
   a.) Spectacle blur
   b.) Unaided and aided visual acuity
   c.) Comfort
   d.) Halos
   e.) Variable visual acuity
   f.) Wearing time

H. Progress examinations at two hours, at two days, one week, two weeks, one month , and then monthly for six months.

I. PEK, 21 point examination, and contact lens evaluation upon close out after 6 months.

J. Definition of successful fit
   a.) 20/25 visual acuity or better
   b.) .50D or less residual astigmatism in over refraction
   c.) Minimum 12 hours wear
   d.) Stable visual acuity
   e.) No subjective complaints
   f.) Patient satisfaction

K. If any of the following occur, either the six month period for the eye involved must be recommenced after the difficulty has been corrected, or the investigation is to be discontinued for that eye.
   a.) Any contact lens defects such as discoloration, fracture, scratch, tear, surface or edge erosion, opacification, or significant change of shape or optical properties which in the investigator's opinion might detract significantly from the efficacy of the lens or might cause any of conditions b through m to occur.
   b.) Failure to achieve 12 hour wearing time within approximately one month after the initial fitting.
   c.) Any significant central corneal staining. Minimal or occasional central stipples are permissable.
   d.) Any persistent gross central or peripheral corneal edema.
   e.) Neovascularization.

f.) A change in keratometer reading or more than one diopter in any meridian compared to the initial readings.
g.) Iritis.
h.) Any conjunctival infection which persists more than two weeks.
i.) Epiphora lasting more than one-half hour after lens insertion after the first two days of lens wear.
j.) Any opacification (including infiltrates) excepting edema.
k.) Significant or unusual discharge from the eye or persistent inflammation of the lids.
l.) Any eye infection.
m.) Instillation of any tropical medication other than normal saline.

L. The present form of record keeping and clinical procedures to satisfy the Food and Drug Administration will be followed. An initial visit examination form (A) should be filled out and signed at the time of the initial visit by the investigator or co-investigator performing the examination. Retain the blue and mail original and yellow copy of the completed and signed form in the return envelope provided to Wesley-Jessen. For follow-up visits (including the two-hour follow-up examination) a follow-up examination form (B) is to be filled out and signed by the investigator or co-investigator performing the examination. If a lens has been changed on any eye, it would not be necessary to repeat any of the above scheduled examinations - (III. Fitting - H.) that have already been performed for that eye. However, the eye with the replacement lens must be examined at least once a month for six months following the initial fitting of that lens if the eye is to be counted as one of the 20 required patients' eyes. In case any ocular abnormality is observed on any follow-up visit, the investigator should see the patient as frequently thereafter as he deems necessary in order to treat and eliminate the abnormality and to document adequately the etiology and duration of the abnormality and the corrective measures taken. For each of these visits a follow-up form should also be completed and signed.

III. PROCEDURE

A. BASECURVE DETERMINATION

Previous work at Pacific with the spherical Dura-Soft ™ (Phemecol) lens and early work with the prism ballast truncated Dura-Soft ™ (Phemecol) lens showed that the physical fit of the lenses did not always correlate with the labeled basecurve of the lenses. For this reason the basecurves of the trial lenses and the new lenses as they arrived were verified by Christian Johansen through a technique he developed as part of his senior thesis project.

Subjects were first fit with a spherical lens and allowed to adapt for one hour before a best fit was found. This was achieved if the lens showed 0.5 - 1mm movement on the blink, 1 - 1.5 mm lag on upward gaze, and minimum lag (1 mm or less) in extreme fields of gaze.

Next the subjects were fit with a prism ballast truncated trial lens and a best fit was achieved. Criteria for the best fit being the same as outlined earlier.

Before the lenses were dispensed the basecurves were verified by a technique developed by Christian Johansen.

B. PRISM BALLAST DETERMINATION

The standard prism ballast trial lens had a ballast of $3/4^{\Delta}$ and a 1 mm truncation at 90° to the base-apex line of the prism. The best fit trial lens was observed with the slit lamp and rotation of the lens was determined with the aid of a protractor reticule in the eyepiece of the slit lamp (See appendix 1). If the estimated rotation was greater than $\pm 5^{\circ}$ more prism was ordered for the lens. If the rotation was $\pm 5^{\circ}$ or less, $3/4^{\Delta}$ ballast was ordered.

C. POWER AND AXIS DETERMINATION

After 15 to 60 minutes a sphero-cylinder over-refraction was performed on the lens that gave optimum movement, centration, and rotation. Using three tests for cylinder, JCC, Pratt Near Cylinder, (See appendix 2), Subjective Cylinder Rock, the best cylinder power and axis were determined along with a best sphere to 20/20. The prescription was then converted to plus cylinder form to be ordered.

When received the lenses were verified with a Nikon projection lensometer for power and axis.

On a few subjects whose lids were slightly slanted, the truncation came to rest on the lid at an angle other than horizontal. In these cases the axis of the cylinder was adjusted so as to still correspond to the patients' corrective axis when the truncation rested on the lower lid at that certain angle. For instance, if the lid was at a 5^{o} angle rather than 180^{o}, the cylinder axis was moved 5^{o} so that when the lens rested on the lid the resultant axis would correspond with the needed axis (Strachan)[6].

D. DIAMATER AND TRUNCATION

The diameter and truncation of the lenses were kept constant. The lenses were ordered 12.8 mm by 11.8 mm with the 1 mm truncation at 90^{o} to the base-apex line of the prism.

IV. RESULTS

The median best fit trial lens for the spheres was found to be 0.4 mm flatter than the flattest keratometry reading. This corresponds to the recommended starting lens in the Dura-Soft™ (Phemecol) fitting guide.

The median best fit trial lens for the prism ballast lenses was flatter than the best fit sphere, with a range of 0.2 steeper to 0.4 flatter than the spheres. The median ballast was $3/4^{\Delta}$ with a range of $\frac{1}{2}^{\Delta}$ to $1\frac{1}{4}^{\Delta}$.

When verified the basecurves were generally found to be flatter than the ordered and labeled basecurves. This corresponds to the actual fit of the lens after it was dispensed. (See table #3) Most lenses were found to be within $\pm$ .25 D in sphere and cylinder power and $\pm 5^{\circ}$ on axis with the projection lensometer.

It was generally found with the prism ballast trial lens that the subjects showed less over-refraction cylinder (0.25 D to 0.50 D) than with the spherical trial lens with no prism ballast.

Initially, patients complained of more discomfort with the prism ballast truncated lens than with the spherical soft lens. Some habitual hard contact lens wearers initially reported that the lenses were more comfortable than their previously worn hard lenses.

Some of these signs were due to the truncation irritating the lid margins. Other signs of "hot" lens and variable vision were probably due to the lenses being too flat and causing excessive movement.

Objective signs were made using the slit lamp microscope and the keratometer. With the lenses on excess rotation and movement were noted in many of the patients whose lenses were verified as flatter than ordered. Without the lens the eye was stained with fluorescein dye. Often after 2 hours of wear, stipple staining was associated with a lens showing too much movement. Stipple staining was also present in the area of the cornea where the truncation changed direction on blink or where excessive rotation of the lens was observed. The overall staining which was present on initial wearing tended to decrease as the wearing time increased to full time.

The keratometer was used to observe for distortion in the cornea after the lenses were removed. Only slight distortion was seen on the first 2 hour follow-up visits. Also, no appreciable changes in corneal curvature were noted.

With the lenses on, an over-refraction generally showed only a small increase in the amount of spherical or cylindrical power, usually .25 to .50 diopter. On a few cases oblique cylinder was found. This was thought

to be due to rotation of the lens on the eye during the over-refraction or from the axis in the lens being off. In these cases, new lenses were ordered which usually resolved the problem.

	K readings	SBC	TBC	VTBC	Power	VA	Δ	Spectacle RX	VA
.P.	48.00/48.25@ 85	8.0	8.2	8.6	- .50+ .75X177	20	1	+ .25-1.00X 92	15
	48.00/48.12@ 90	8.0	8.2	8.6	- .50+1.00X160	20	1	pl-1.00X 72	15
.C.	45.75/47.00@150	8.2	8.4	8.4	-7.75+1.25X 76	20+	¾	-7.75-2.50X178	20+
	45.25/45.75@ 90	8.2	8.4	8.4	-7.00+1.25X 87	20+	¾	-7.00-2.00X 02	20+
M.H.	43.12/42.50@ 90	8.0	8.2	8.5	-4.75+1.25X180	15	¾	-3.50-1.50X 90	15
	42.87/42.12@ 90	8.0	8.2	8.3	-4.00+1.00X180	15	¾	-3.00-1.00X 83	15
D.M.	42.62/42.50@ 90	8.2	8.4	*	-1.75+ .50X175	20+	1	-1.00- .75X 96	15
	42.62/42.75@ 90	8.2	8.4	*	-2.00+ .75X175	20+	1	-1.00- .75X 94	15
T.S.	45.00/46.00@ 67	8.0	8.0	8.4	-6.00+1.00X 83	15	1¼	-5.50-1.25X127	15
	45.75/47.00@103	8.0	8.0	8.4	-6.75+1.00X135	20+	1¼	-6.25-1.50X 45	15
.C.	39.62/41.75@110	8.8	8.6	*	-5.50+ .75X115	15	¾	-4.75-1.00X 25	15
	39.62/41.12@ 87	8.8	8.6	*	-7.00+1.25X180	15	¾	-5.75-1.25X170	15
.C.	42.00/43.50@ 60	8.2	8.0	8.4	-2.25+1.00X 78	15	¾	-1.50-1.00X155	15
	41.87/44.00@105	8.2	8.0	8.4	-1.25+1.50X105	15	¾	+ .50=2.25X 15	20
.K.	44.00/46.00@ 90	8.0	8.0	8.2	-8.00+2.25X 90	15	¾	-7.00-2.50X180	15
	44.00/46.00@ 90	8.0	8.0	8.4	-7.25+2.25X 93	15	¼	-6.00-2.50X178	15
G.W.	43.87/45.75@ 90	8.2	8.6	8.8	-8.00+1.00X 93	30	¾	-7.75- .50X 10	60
	43.75/45.00@ 90	8.2	8.6	8.8	-8.00+1.25X 60	20	¾	-8.00-1.50X170	20
S.D.	44.62/45.00@ 90	8.4	8.8	8.8	-3.00+ .50X105	15	1	-2.50- .50X 15	15
	44.62/45.00@ 90	8.4	8.8	8.8	-3.50+ .50X 30	15	1	-3.50- .75X120	15
P C.	45.62/45.25@ 93	8.2	8.2	*	-4.00+1.00X178	15	¾	-3.25-1.75X 90	15
	42.87/45.75@ 96	8.2	8.2	*	-3.75+1.00X174	15	¾	-3.25-1.25X 90	15
I D.	44.00/45.87@ 90	8.4	8.4	8.5	-3.50+ .50X 80	15	½	-3.00- .75X170	15
	43.50/46.00@ 81	8.4	8.4	8.5	-3.75+1.00X 90	15	½	-2.75-1.25X180	15

TABLE 1. PATIENT DATA

	K readings	SBC	TBC	VTBC	Power	VA	Δ	Spectacle RX	VA
.G.	44.87/42.50@ 87	8.2	8.4	8.5	-3.50+2.75X175	20	¼	- .50-3.25X 85	15
	45.00/42.00@ 80	8.2	8.4	8.5	-4.00+3.00X180	15	¾	- .50-3.00X 84	15
L.S.	48.00/47.75@180	8.3	8.5	*	-2.75 sphere	15	¾	-2.50- .50X 25	20
	47.50 sphere	8.3	8.5	*	-2.75+1.50X 40	15	¾	-2.50-1.00X135	20
J.P.	44.00 sphere	8.3	8.4	*	-2.75 sphere	15	1	-2.50- .25X135	20+
	43.50/44.50@ 70	8.2	8.4	*	-3.00+ .50X 75	15	1	-2.50-1.00X155	20+

*- Lenses not dispensed yet.

S.B.C. - Sphere basecurve - verified

T.B.C. - Toric basecurve - verified - from trial lens set

V.T.B.C. - Verified basecurve of dispensed lens

The lenses were ordered the same as T.B.C.

V.A. - Visual acuity

Δ- Prism in lens

TABLE 1. (Continued)

V. DISCUSSION

The authors feel that the most important key to the success of these lenses is patient motivation. The best candidates were previous hard or soft contact lens failures due to residual astigmatism not one that failed because of adaptive problems. We would recommend that the patient be adapted to spherical soft lenses prior to the fitting of the toric lenses. This could be done between the time of initial diagnostic fitting and the actual time the lens returned from the lab. The patient should also be forwarned that the torics will not be as comfortable initially as the sphericals. It was also noted that the cylindrical component often decreased, as compared to the spectacle refraction and the spherical over-refraction with the spherical prism ballast trial lenses. This in itself is a good reason for having a prism trial lens set as it gives a more accurate over-refraction.

<u>If the axis of the cylinder cannot be rotated ± 5° without a noticeable blur, we would not recommend this patient as a good candidate.</u>

One of our problems encountered was the time delay in getting lenses. Due to this delay we were not able to quickly receive or replace a lens, thus, full time wear was only achieved by three patients.

We are hopeful that this will be resolved as production of these lenses increases.

The finish of the truncation varied from lens to lens. Patients with lenses that had a sharp junction on the corner of the truncation had many more complaints concerning comfort. Some work needs to be done in the area of in-office modification of these lenses. If this junction could be smoothed, or be delivered smooth, many of the comfort problems would be solved. Receiving the basecurve as specified would result in fewer problems. Patients with flatter than specified basecurves were the ones that had the most problems. The second most common problem, was having the cylinder off axis. Retruncating the lens might alter the axis enough to avoid ordering a new lens. (See table #4)

The practitioner is also cautioned not to underestimate the time required to fit these lenses. This involves the extra time needed for cylinder power and axis determination.

26% of the patients achieved better acuity through the contact lenses than through the spectacle correction.

26% of the patients achieved better acuity with spectacles than with contact lenses.

47.8% achieved the same acuity through the contact lenses as through the spectacles. (See table #1)

VI . CONCLUSIONS

A practitioner should have these lenses:

Basecurve	Power	Prism
8.0	Plano	3/4
8.0	-4.00	3/4
8.2	Plano	3/4
8.2	Plano	$1\frac{1}{4}$
8.2	-4.00	3/4
8.4	Plano	3/4
8.4	Plano	$1\frac{1}{4}$
8.4	-4.00	3/4
8.6	-3.00	1
8.8	-3.00	1

Each lens would be spherical with a single 1 mm truncation 90° to the base apex line.

It must be kept in mind that these data are from a small population and that more data are needed.

This guide takes into account the two major variables K_f and K cylinder:

Corneal Cylinder

K_f	0 - .75	.87 - 1.50	1.62 - 2.25	2.37 - 3.00
41:00-43:00	.3 - .5	.3	.3 - .25	.3 - .2
43:25-45:00	.9 - 1.1	.75 - .9	.6 - .75	.6 - .45
45:00-48:00	.95 - 1.4	.65 - .95	.65 - .3	.3 - 0

Millimeters Flatter than K_f

From these limited data some generalizations can be drawn. A good recommended starting point would be .6 flatter than K_f on corneas 43.00 and lower and .8 flatter than K_f on corneas steeper than 43.00 A practitioner will then have to steepen the basecurve as the corneal cylinder increases.

If the patients are chosen well a practitioner should have a high success ratio.

There is a definite need for a lens to correct for residual astigmatism. The Dura-Soft astigmatic lens can be a viable solution to this problem.

What is needed now is a larger sample of patients to be fit with the lenses. This will allow more accurate determination of the interaction of basecurve and corneal cylinder. The patients will also have to be followed over time to explore what happens with long time wear of these lenses.

TRIAL LENS SET

(Received as a gift from Wesley-Jessen, Inc.)

TABLE 2

Lens #	Labeled Basecurve	Measured Basecurve
1	7.8	7.8
2	7.8	7.8
3	8.2	8.5
4	8.0	8.0
5	8.2	8.5
6	8.4	7.9
7	8.0	8.0
8	8.6	8.4
9	8.0	7.8
10	8.4	8.8
11	8.4	8.3
12	8.8	9.1
13	8.2	8.6
14	8.6	8.8

TABLE 3

	ORDERED BASECURVE	BASECURVE RECEIVED
B.P.	8.2 8.2	8.6 8.6
B.C.	8.4 8.4	8.4 8.4
H.H.	8.2 8.2	8.5 8.3
B.M.	8.4 8.4	
T.S.	8.0 8.0	8.4 8.4
P.C.	8.6 8.6	
G.C.	8.0 8.0	8.4 8.4
B.K.	8.0 8.0	8.2 8.4
G.W.	8.6 8.6	8.8 8.8
S.D.	8.8 8.8	8.8 8.8
P.C.	8.2 8.2	
I.D.	8.4 8.4	8.5 8.5
M.G.	8.4 8.4	8.5 8.5

TABLE 3 (Continued)

	ORDERED BASECURVE	BASECURVE RECEIVED
L.S.	8.5 8.5	
J.P.	8.4 8.4	

#3

	Power Ordered	BC	Δ	Power Rec'd	VBC	Reorder*	Reordered Lens	BC	Δ	Power Rec'd	VBC
BP	- .50+ .75X177	8.2	1	- .50+ .75X177	8.6	1,5,6	- .25+ .75X177	8.2	¾		
	- .50+1.00X160	8.2	1	- .50+1.00X166	8.6	1,5,6	+ .25+1.00X160	8.2	¾		
BC	-7.75+1.25X 76	8.4	¾	-7.75+1.25X 74	8.4	5	-7.75+1.25X 76	8.2	¾		
	-7.00+1.25X 78	8.4	¾	-7.25+1.25X 82	8.4	5	-7.00+1.25X 78	8.2	¾		
HH	-4.75+1.25X180	8.2	¾	-4.75+1.25X180	8.5	1,2,5,6	-5.00+1.50X180	8.2	1		
	-4.00+1.00X180	8.2	¾	-4.00+1.00X180	8.3	3,5,6	-4.00+1.00X175	8.2	1		
DM	-1.75+ .50X175	8.4	1								
	-2.00+ .75X175	8.4	1								
TS	-6.00+1.00X 83	8.0	1¼	-6.00+1.00X 78	8.4	3,5,6	-6.00+1.00X 83	8.2	1		
	-6.75+1.00X135	8.0	1¼	-6.75+1.00X135	8.4	5,6	-6.75+1.00X135	8.2	1		
PC	-5.50+ .75X115	8.6	¾								
	-7.00+1.25X180	8.6	¾								
GC	-2.25+1.00X 78	8.0	¾	-2.25+1.00X 80	8.4	5	-2.25+1.00X 78	8.0	¾		
	-1.25+1.50X105	8.0	¾	-1.25+1.25X105	8.4	5	-1.25+1.50X105	8.0	¾		
BK	-8.00+2.25X 90	8.0	¾		8.2	1,2,4,6	-7.25+2.00X 90	8.4	1¼		
	-7.25+2.25X 93	8.0	¾		8.4	1,6	-6.50+2.25X 93	8.4	1¼		
GW	-8.00+1.00X 93	8.6	¾	-8.00+1.00X 93	8.8						
	-8.00+1.25X 60	8.6	¾	-8.00+1.25X 60	8.8						
SD	-3.00+ .50X105	8.8	1	-3.00+ .75X105	8.8						
	-3.50+ .50X 30	8.8	1	-3.50+ .50X 32	8.8						

TABLE 4. LENS SPECIFICATIONS

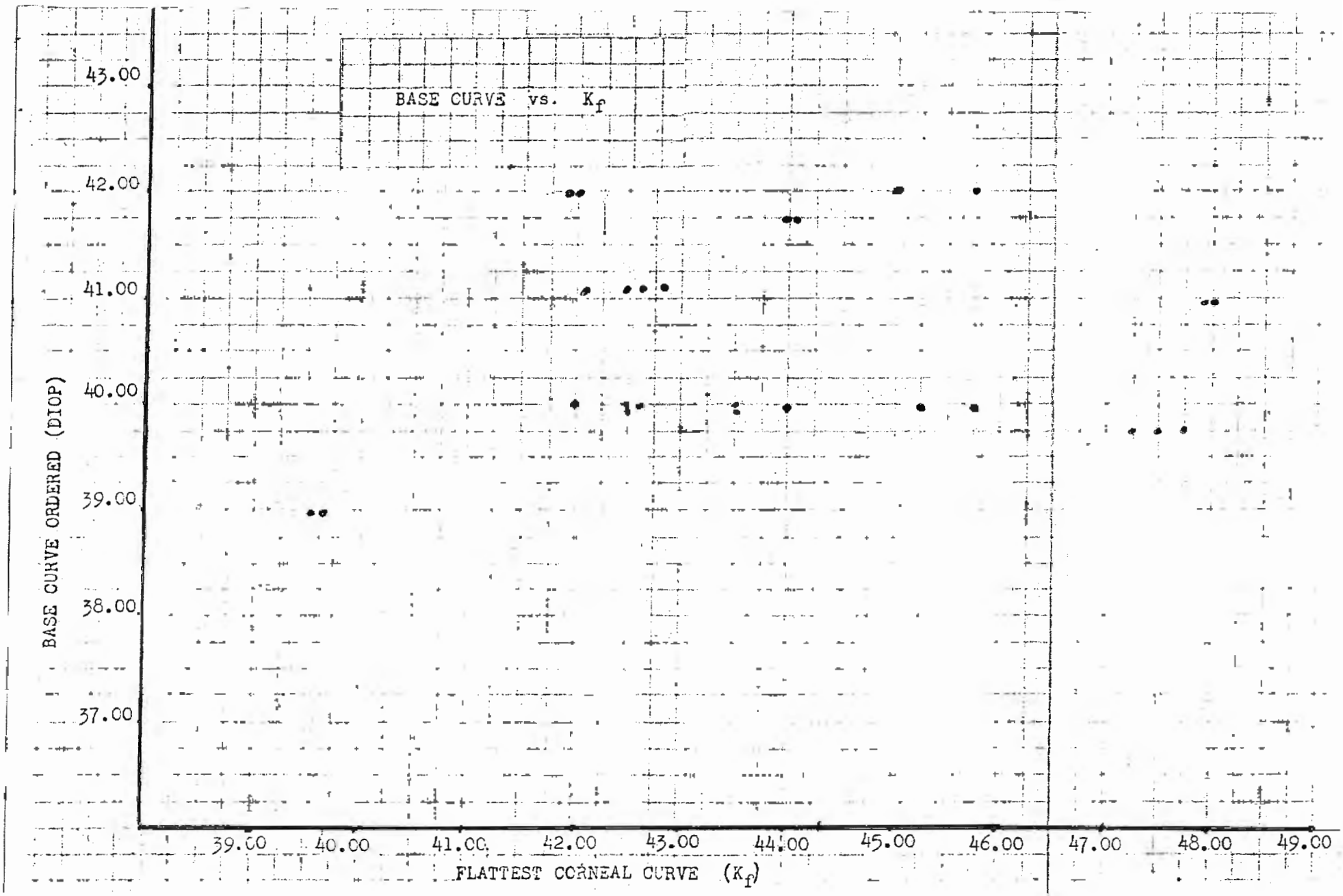
	Power Ordered	BC	Δ	Power Rec'd	VBC	Reorder*	Reordered Lens	BC	Δ	Power Rec'd	VBC
PC	-4.00+1.00X178	8.2	¾								
	-3.75+1.00X174	8.2	¾								
ED	-3.50+ .50X 80	8.4	½	-3.50+ .50X 80	8.5	4,6	-3.50+ .50X 80	8.6	1		
	-3.75+1.00X 90	8.4	½	-3.75+1.00X 90	8.5	4,6	-3.75+1.00X 90	8.6	1		
MG	-3.50+2.75X175	8.4	¾	-3.50+2.75X160	8.5	1,2,5,6	-3.75+3.25X175	8.4	1		
	-4.00+3.00X180	8.4	¾	-4.60+2.50X180	8.5	3,5,6	-4.00+3.00X174	8.4	1		
LS	-2.75 sphere	8.5	¾								
	-2.75+1.50X 40	8.5	¾								
JP	-2.75 sphere	8.4	1								
	-3.00+ .50X 75	8.4	1								

B.C. - Basecurve

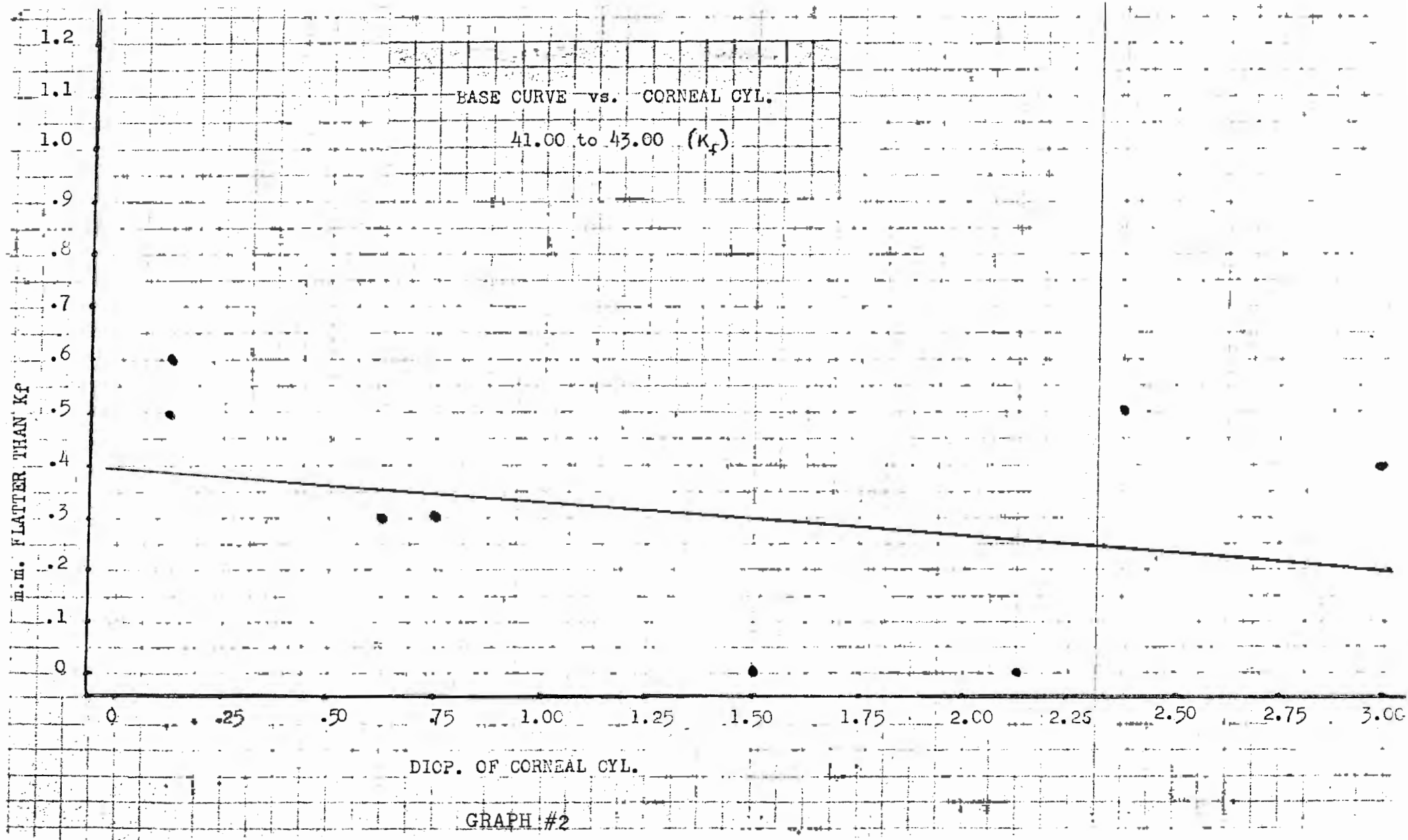
V.B.C. - Verified basecurve

* Reasons for reorder
1. Sphere power changed
2. Cylinder power changed
3. Axis changed
4. Reorder basecurve flatter than VBC
5. Reorder basecurve steeper than VBC
6. Change Prism

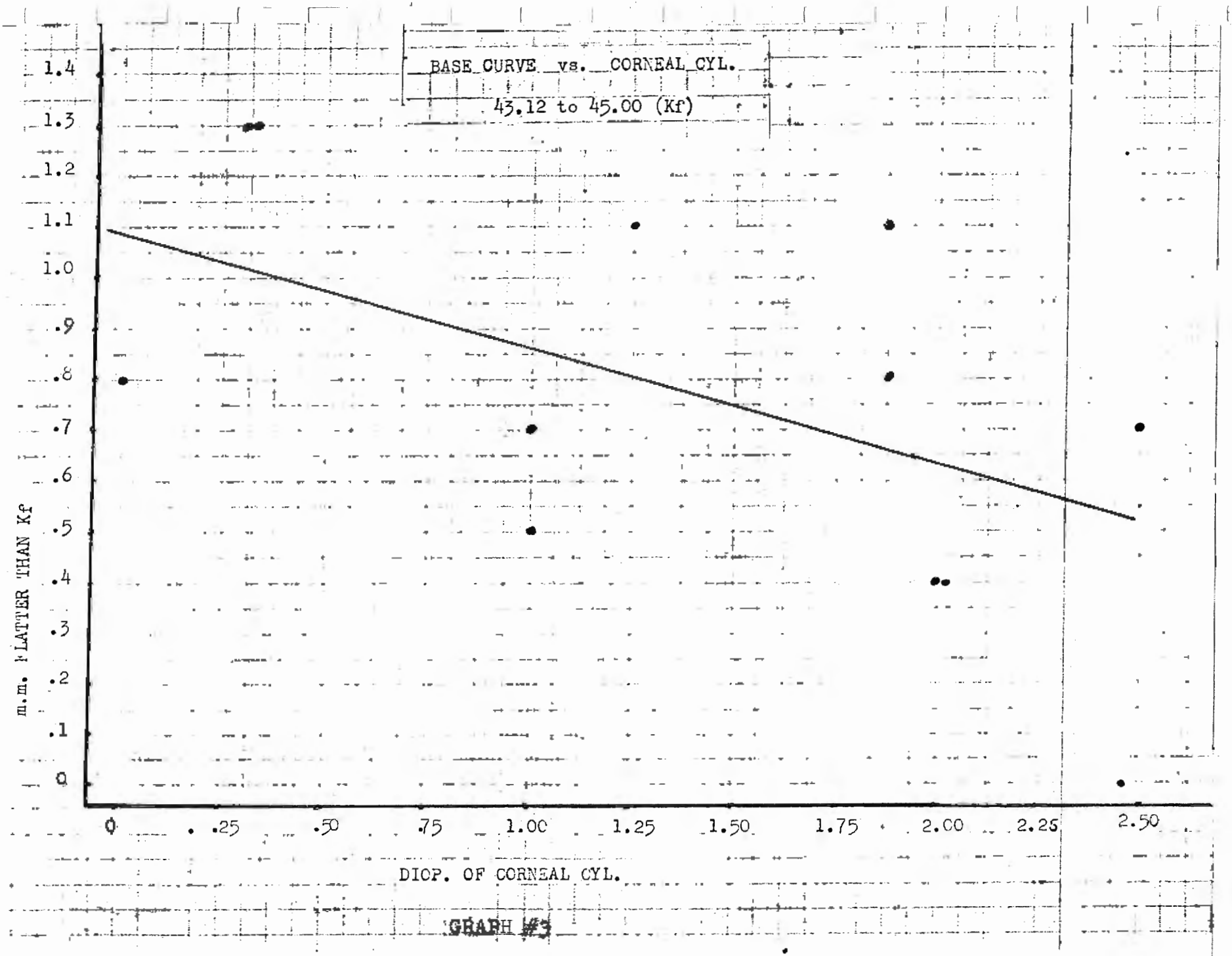
TABLE 4. (Continued)


BASE CURVE vs. K_f
43.00
42.00
41.00
40.00
39.00
38.00
37.00
BASE CURVE ORDERED (DIOP)
39.00
40.00
41.00
42.00
43.00
44.00
45.00
46.00
47.00
48.00
49.00
FLATTEST CORNEAL CURVE (K_f)

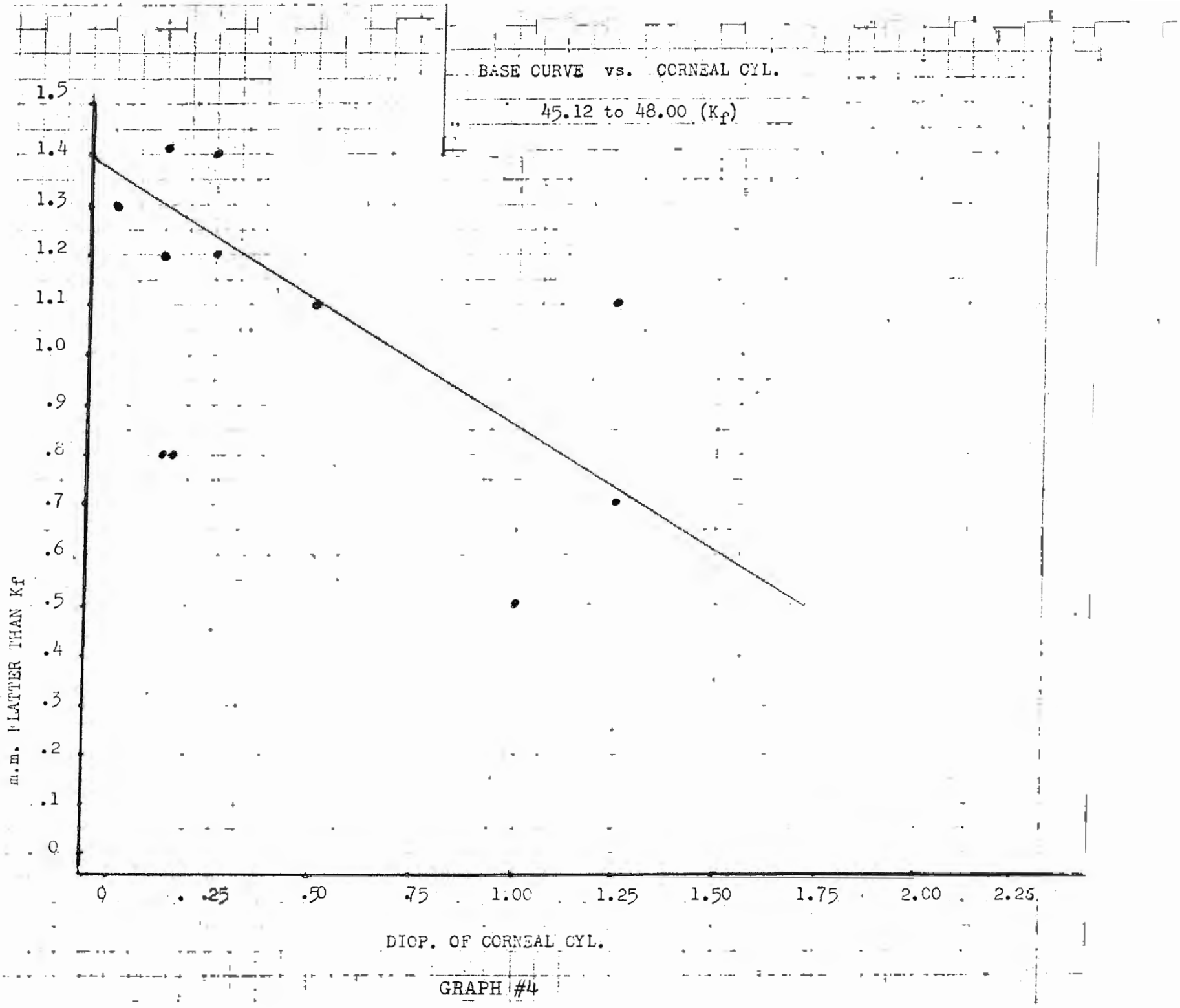
GRAPH #1


BASE CURVE vs. CORNEAL CYL.
41.00 to 43.00 (K_f)
m.m. FLATTER THAN Kf
1.2
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
0
.25
.50
.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
DIOP. OF CORNEAL CYL.

GRAPH #2


BASE CURVE vs. CORNEAL CYL.
43.12 to 45.00 (Kf)
m.m. LATTER THAN Kf
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
0
.25
.50
.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
DIOP. OF CORNEAL CYL.

GRAPH #3


BASE CURVE vs. CORNEAL CYL.
45.12 to 48.00 (Kf)
m.m. FLATTER THAN Kf
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
0
.25
.50
.75
1.00
1.25
1.50
1.75
2.00
2.25
DIOP. OF CORNEAL CYL.

GRAPH #4

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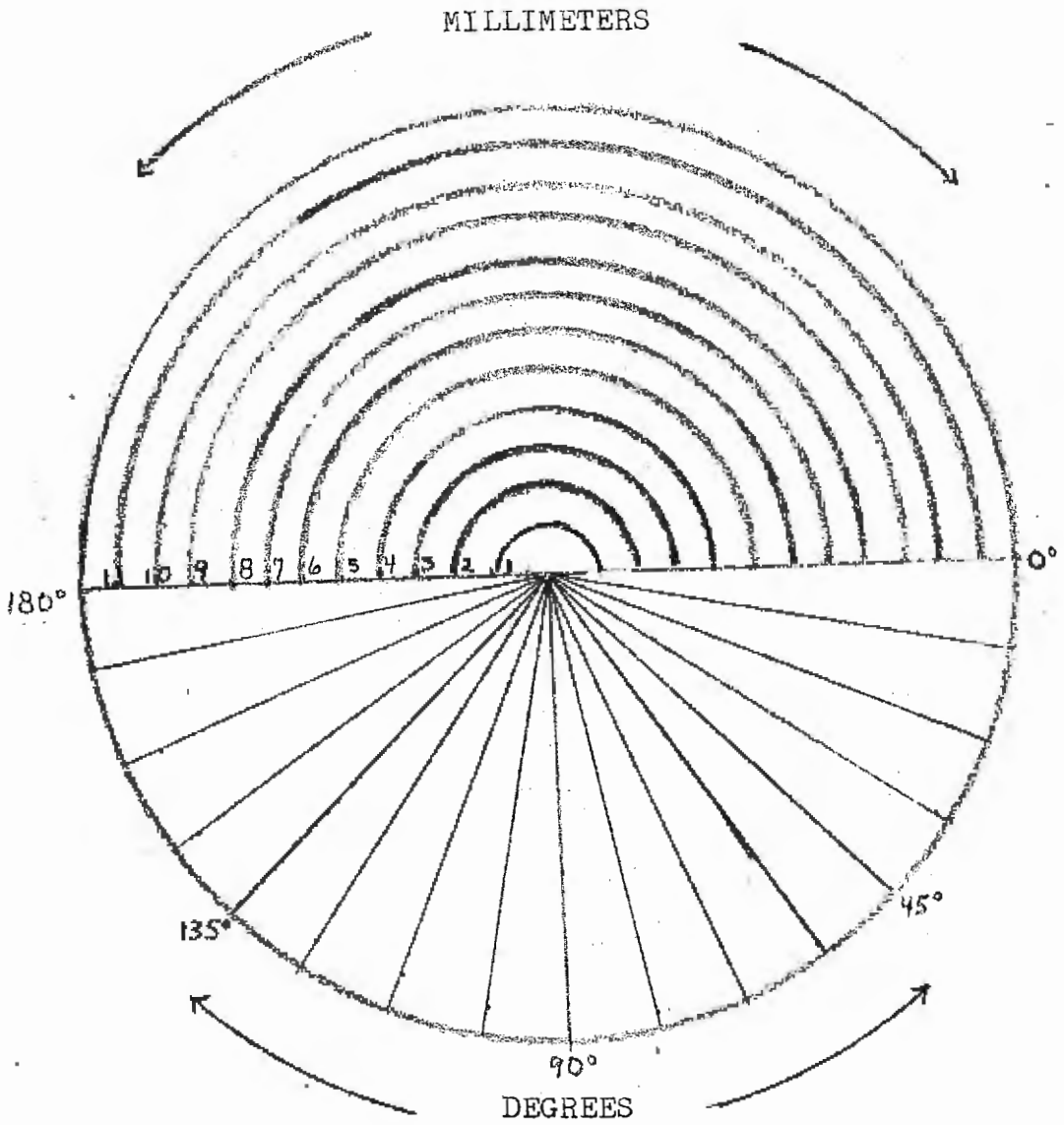
APPENDIX 1



The reticule seen through eyepiece of the slit lamp as is used to measure degrees rotation of the truncated soft lens.

APPENDIX II.

PRATT NEAR CYLINDER TEST

Introduction:

This procedure provides an additional method for determining the cylindrical component of a correction. Not all patients can respond well or quickly to the standard J.C.C. test or the cylinder rock test. It is important that several different techniques for obtaining a given result be mastered so that when a patient does not respond to one technique, a different technique can readily be used. The near cylinder test results correlate extremely well with the results of the more familiar cylinder tests, and it is an excellent alternate method to have at your disposal.

Targets:

1) Reduced snellen card

2) Vertical and horizontal near point cross cylinder card (on reverse side of reduced snellen card)

3) Obliquely crossed cylinder near point card (cross cylinder orientated at 45 and 135 degrees)

Illumination:

1) Standard near point testing illumination will be used through out the entire test (i.e. the same illumination that is used for the near point relative convergence and accommodative tests)

Control lens:

1) Monocular negative relative accommodation recovery lens (21 monocular recovery lens)

The near cylinder test is performed with this control lens so that the patient's accommodative posture is placed as close to the far point posture as possible.

Procedure:

1) With the patient comfortably seated behind the phoropter, place the reduced snellen card in the reading rod holder and set the holder at the 16 inch distance. Set the phoropter at the patient's near point p.d.

2) Occlude the left eye, and run a standard 21 monocular blur out and recovery on the right eye. (Run the 21 monocular test with no cylindrical correction in the lens bank) Leave the 21 monocular recovery lens in place.

3) Repeat above procedure for the left eye, again leaving the recovery lens in place.

4) Again occlude the left eye and un-occlude the right eye.

5) Flip the reduced snellen card around so that the vertical cross cylinder faces the patient. Place the oblique cross cylinder card in the reading rod holder back to back with the vertical card. (The cards are placed back to back so that by merely flipping the holder around the patient sees either the vertical or oblique card.)

6) With the vertical card facing the patient, the patient is asked which set of lines appear darker, the vertical or the horizontal lines.

7) As in the clock dial test, if the patient reports that the vertical lines appear darker, rotate the cylinder axis on the phoropter to 180 degrees.

8) If the patient reports that the horizontal lines appear darker, rotate the cylinder axis on the phoropter to 90 degrees.

9) Add minus cylinder lenses until the patient reports a reversal (i.e. the dark appearing set of lines switches from one set to the other) The patient is asked to report which set of lines are darker after each 0.25 diopter of power is added.

10) After reversal has been obtained, flip the card holder around so that the oblique cross now faces the patient.

11) Again ask the patient which set of lines appear darker, the ones going up and to the right or the ones going up and to the left. (You may wish to identify these lines by placing one small dot above one set of lines and two small dots above the other set of lines. Then, the patient can be instructed to tell you which set of lines appear darker, the set with one dot above it or the set with two dots above it.)

12) If the patient reports that the darker set of lines is up and to the right, rotate the cylinder axis toward 45 degrees until reversal is

reported. (i.e. rotate the cylinder axis towards the lighter appearing lines) The axis is rotated slowly, and the patient is asked to report which set of lines appear darker after each 15 degrees of rotation.

13) If the patient originally reports that the set of lines going up and to the left appear darker, rotate the cylinder axis towards 135 degrees until reversal is obtained.

14) Once reversal has been obtained, rotate the cylinder axis back toward its original position, instructing the patient to say "now" when both sets of lines appear equal. (equally dark)

15) When this equality point is reached, stop rotation of the axis. This is the axis of the correcting cylinder lens. (This equality point can be checked by approaching it several times from each direction and having the patient report "now" each time the lines appear equally dark.)

16) After the axis of the correcting cylinder has been determined, flip the reading rod holder around once more so that the vertical cross once again faces the patient.

17) Again ask the patient which set of lines appear darker, vertical or horizontal.

18) If the patient reports that both sets of lines are equally dark, the test is complete, and the lens in the bank is the correcting cylinder lens.

19) Since this part of the test was originally run to reversal, the patient will probably report the same set of lines appearing darker as he did at the end of step (8). (The set of lines which most closely parallels the cylinder axis will probably appear darker.)

20) Reduce the cylinder power in 0.25 diopter steps asking the patient after each reduction to report which set of lines appear darker. When the patient reports that both sets of lines are equally dark, the test is complete and the lens in the bank is the correcting cylinder lens.

21) If, at the end of step (17), the patient now reports that the opposite set of lines now appears darker than appeared darker at the end of step (8), add minus cylinder lens power until reversal is obtained and repeat steps (10) through (20).

22) Repeat the above procedure, steps (6) through (21), for the left eye.