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A comparison of "small" versus "large" diameter rigid gas permeable fitting philosophies

Alan Beckman
Pacific University

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Pacific University

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Abstract
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Degree Type
Thesis

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A COMPARISON OF "SMALL" VERSUS "LARGE" DIAMETER RIGID GAS PERMEABLE FITTING PHILOSOPHIES.

BY

ALAN BECKMAN
&
SCOTT ARMER

A thesis submitted to Pacific University
College of Optometry for the degree of Doctor of Optometry May 1992.

Advisor... James E Peterson O.D.
A Comparison of “Small” Versus “Large Diameter Rigid Gas Permeable Fitting Philosophies.

Alan Beckman (Intern)

Scott Armer (Intern)

James E. Peterson, O.D. (Advisor)
ACKNOWLEDGEMENTS

We thank Dr. James Peterson for his instruction and guidance throughout the research project. We would also like to thank John Panichello and Opticon for their contribution of the contact lenses. We would also like to thank Permeable Contact Lenses for contributing the contact lens buttons. Also we would like to thank Pacific University College of Optometry for the use of their facilities and contact lens solutions. Finally we would like to thank our subjects. Their effort and punctuality made this project possible.
Abstract

This project was designed to compare small and large diameter contact lens fitting philosophies when prescribing rigid gas permeable lenses. The purpose was to find out which fitting philosophy would result in a more comfortable contact lens fit. Subjective response was used as a means for comparison. At the start of the study ten patients were fit with both large and small diameter SGP III fluorosilicone-acrylate contact lenses. Half of the subjects were dispensed large diameter lenses and the other half were dispensed small diameter lenses. The subjects wore the lenses until they became fully adapted and then they filled out a lens evaluation form and were dispensed the alternate diameter lenses. After adapting to these lenses, they filled out another lens evaluation form. The large lenses showed better overall comfort as well as initial comfort. They also showed better vision and less flair. The small lenses gave better comfort in a reading environment, less dry eye problems, and less foreign particle problems.

Keywords: Large and Small Lens Fitting Philosophies, SGP III, Fluorosilicon-acrylate, Fully Adapted.
Introduction

The recent advances in contact lens material have allowed the practitioner to use larger diameters of contact lenses. In former years materials such as PMMA have limited the diameter of contact lenses, because the material would not let enough oxygen through to the cornea and edema resulted. Higher Dk values in the newer materials allow more oxygen to reach the cornea. This has allowed fitters of hard contact lenses to increase the diameter of the lenses without compromising the corneal integrity. But are these larger lenses in fact better for the cornea and is patient comfort increased with these larger diameter lenses?

There are many fitting strategies being used by practitioners today. Two of the major strategies consist of the Interpalpebral fit, and the large fitting philosophy. In the Interpalpebral fitting philosophy the lens is fit using a smaller diameter, with a base curve steeper than the flattest corneal curvature. The lens to cornea relationship will sometimes show central pooling of fluorescein. The total lens diameter is determined by the corneal diameter and the vertical separation of the lids when the eyes are open. When this lens is properly fit the lens should snap back into place when the eye lids are spread open and the lens is manually pushed towards the limbus. Similar action is seen during the blink as adherent forces cause the lens to center on the apex of the cornea. Lid interaction is not necessary to keep the contact lens centered on the cornea. Fitters that use this philosophy state that they get less changes in with-the-rule astigmatism, greater movement, less translimbal inflammatory response syndrome, and less central corneal clouding. Drawbacks of this fitting philosophy are flair and glare that is a result of the smaller optic zones. Proponents of the small fitting philosophy state that this flair can be reduced by using a good blending process to decrease the curvature change between the base and peripheral curves.

The other major type of fitting technique is to fit large and close to the flattest K. This philosophy has increased in popularity with the increase in Dk of the newer contact lens materials. The larger lenses fit by this method should come to rest within the limbal boundary and the superior edge should be positioned under the upper lid. It is
this lid interaction that helps the lens to center on the cornea. This interaction between the lens and the lid is said to increase comfort since lens edge and lid margin interaction is reduced.\textsuperscript{7,9} Some fitters use diameters that allow one fourth to one third of the lens to be tucked under the upper lid.\textsuperscript{8} Lenses are fit on alignment with the flattest corneal curvature, flatter than the flattest corneal curvature, or with slight apical clearance.\textsuperscript{7} Diameters vary from one fitter to the next as to how large to go. Most stay in the range between 9.0 and 10.5 mm in diameter. With the larger optical zones offered by these lenses fitters say that the lenses give less flair and glare then their smaller counterparts. Lens lag and blur are decreased during blinking.\textsuperscript{9} A drawback to the larger lenses is that they show a larger edge lift. This leaves an open channel for foreign material to move beneath the lens and result in corneal abrasions.\textsuperscript{2}

The purpose of this study was to determine which of these lens fitting philosophies would result in a more comfortable contact lens fit. Patients subjective responses were used to rate each lens. The major focus of the study was patient comfort, but other subjective aspects considered were flair, lens centration, ease of insertion and removal, ease of cleaning, foreign body problems, vision clarity, and lens performance in a distance and a reading environment.

\textbf{Procedure}

This project involved the wear of SGP III Rigid Contact Lenses. The lens material is one of the newest fluorosilicon-acrilates available. Subjects were picked from a flier and sign up sheet that was circulated to the optometry students of Pacific University. From that list subjects were picked who showed less than one and a half diopters of corneal astigmatism, no previous ocular pathology, or contact lens complications.

The subject population for this project consisted of ten optometry students from Pacific University. They had a variety of previous contact lens experience. Six of the subjects were male and four of the subjects were female. They ranged in age from age twenty three to age thirty four. Of the twenty eyes fit six showed simple myopia,
fourteen showed myopia with astigmatism. One was a spherical cornea, fifteen were with-the-rule astigmatism, and four were against-the-rule astigmatism.

PATIENT PROFILE:

TABLE 1 PREVIOUS CTL EXPERIENCE

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<thead>
<tr>
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<tr>
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<td>1</td>
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<tr>
<td>SCL</td>
<td>3</td>
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<tr>
<td>RGP+SCL</td>
<td>2</td>
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<tr>
<td>RGP+SCL+PMMA</td>
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<tr>
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TABLE 2 CORNEAL ASTIGMATISM

<table>
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<tr>
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<td>.00-.25</td>
<td>7</td>
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<tr>
<td>.37-.75</td>
<td>10</td>
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<tr>
<td>.87-1.25</td>
<td>2</td>
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<td>1.25-2.00</td>
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TABLE 3 LENS PARAMETERS

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<th>Range</th>
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<tbody>
<tr>
<td>Small Lenses</td>
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<td></td>
</tr>
<tr>
<td>Base Curve</td>
<td>7.36</td>
<td>7.00-7.58</td>
</tr>
<tr>
<td>Diameter</td>
<td>8.14</td>
<td>7.60-8.20</td>
</tr>
<tr>
<td>Center Thickness</td>
<td>.126</td>
<td>.11-.14</td>
</tr>
<tr>
<td>Power</td>
<td>-4.87</td>
<td>-0.75--10.75</td>
</tr>
<tr>
<td>Large Lenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Curve</td>
<td>7.52</td>
<td>7.00-8.00</td>
</tr>
<tr>
<td>Diameter</td>
<td>9.15</td>
<td>9.00-9.50</td>
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<tr>
<td>Center Thickness</td>
<td>.140</td>
<td>.11-.17</td>
</tr>
<tr>
<td>Power</td>
<td>-3.82</td>
<td>-0.25--11.75</td>
</tr>
</tbody>
</table>

Each subject was given a complete refraction and an examination of ocular health to rule out the presence of pathology. Subjects first attended a fitting session where they were fit with both diameter contact lenses. Small lenses were fit steeper than the flattest corneal curvature so that the lens centered on the eye when freed from the
lids. The small lenses were ordered as bicurves with B blends. Peripheral curves were ordered 3 mm flatter than the base curve and 0.4 mm wide. Most of the large lenses were ordered on or flatter than the flattest corneal curvature. Some were ordered steeper. The large lenses were ordered as tricurves with B blends. Peripheral curves were obtained from the Polycon II contact lens peripheral curve chart.

Half of the subjects were dispensed large diameter contact lenses and half were dispensed with the small diameter lenses. Subjects used the Boston Advance cleaning solution, conditioner, and reconditioning drops. All were counseled on lens insertion and removal as well as lens care. They were followed at one week, two weeks, one month, and three months. Follow ups did vary from one patient to the next as problem patients required more follow ups and modifications. Subjects were asked to build wearing time after dispensing and to contact the experimenters if they were having any problems in between follow up visits. This helped to insure that problems were dealt with quickly so that wearing time could be built in a similar manner with both diameter lenses.

At each follow up visit the contact lens fit was evaluated by fluorescein for arc staining, three/nine staining, and fluorescein pooling pattern. Lens centration, both vertical and horizontal were evaluated. Also done at every follow up was visual acuity testing, a sphero-cylinder over refraction, lens off keratometry and a lens off sphero-cylinder refraction. Lens modifications were made when necessary. The goal was to follow the patients until they had built up comfortable wearing time to a maximum, and had become fully adapted to the contact lenses. Subjects were fully adapted to the lenses when they had a comfortable wearing time of twelve hours to full day wear, and did not show staining. Another criterion for the patient to be fully adapted was keratometric changes of no more than 0.50 D, and lens off refraction changes of no more than 0.50 D from prefitting values. When the subjects were fully adapted they filled out a lens evaluation form and were dispensed the alternate diameter contact lens. They were then followed in a similar manner for the second pair of lenses. Photographs were taken of one of the subjects to show examples of the large and small fits.
Results

All of the ten subjects that started the project were successfully fit, except one who was not able to adapt to the large diameter lenses. This subject showed against the rule corneas and a large lens could not be successfully fit. The rest of the fits were all successful with the subjects obtaining full day wearing time without discomfort. Table four shows the average of the subjective responses to the different diameter contact lenses. These results were taken from the patient questionnaire form that was filled out by the subjects as soon as they became adapted to the lenses.

Keratometric as well as lens off refraction findings are shown in table five. These were taken at the initial fitting exam as well as at each follow-up exam, but the results found in table five are only the initial and final results for each diameter lens. Larger corneal changes were noted during the course of adaptation to the lens, but with modifications such as blends and edge profile changes the corneal and refractive changes returned to those found in table five by the time that the subjects adapted to the lenses. Three eyes did not reach our keratometric goal of 0.50 D change when the subject were adapted to the lenses. They were within 0.75 of their original keratometric findings. Examples of the large and small fits on a subject with 10 D of myopia are depicted in table six. Observe the lenses not the shadow on the cornea.

DISCUSSION

The large lens fitting philosophy showed better over all comfort and better initial comfort than the small diameter. This may be due to the fact that the lens is interacting with the upper lid in such a way to increase the comfort of the lens. The large lens was also shown to be easier to remove and easier to clean. The reason for this may be that the small lenses were fit steeper than the large lenses. Fluid adherence forces cause the small lens to stick to the corneal apex more strongly.

The small lenses showed better centration than the large lenses. This again is primarily due to the adhesive forces. The small lenses demonstrate a snap back during the blink phase, because the small lenses recenter faster than the large lenses. The small lenses showed less of a problem with foreign particles than the large lenses. The cause for this may be that the larger lenses show more of an edge lift
than the small lenses. This edge lift allows for foreign particles to get stuck in the peripheral curve reservoir and with the blink move under the lens. Less dry eye problems were experienced with the small lenses. The small lenses cover less of the corneal surface than the large lenses. They also move farther with each blink. These two factors cause the small lens to show less dry eye problems. The small lens gave better comfort in a reading environment. When a person is reading more attention is paid to the reading task. Blink rate decreases and dry eye problems increase. The small lens also centers faster so there will be less of a problem with blink associated blur.

CONCLUSION

The large lenses showed a better over all comfort as well as initial comfort than the small lenses. They also provided better vision and less flair. The small lenses gave better comfort in a reading environment, less dry eye problems, and less foreign particle problems. If the lens is to be worn where reading or environmental dust is a problem the small diameter should give better results. Otherwise the large lenses give better overall comfort. No one fitting philosophy works on all patients. The fitter needs to be aware of many fitting techniques to have the highest success rate with patients with a wide range of needs.
Table 4
Patient Subjective Responses

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Pt. Responses</th>
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<tbody>
<tr>
<td>Comfort</td>
<td>Large Lenses</td>
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<td>Insertion</td>
<td>Small Lenses</td>
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<td>InitialComfort</td>
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<tr>
<td>ForeignBody</td>
<td>Large Lenses</td>
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<tr>
<td>RemovalEase</td>
<td>Small Lenses</td>
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<tr>
<td>CleaningEase</td>
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</tr>
<tr>
<td>Visionclarity</td>
<td>Large Lenses</td>
</tr>
<tr>
<td>Flair</td>
<td>Small Lenses</td>
</tr>
<tr>
<td>Centration</td>
<td></td>
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<tr>
<td>ActiveEnv.</td>
<td>Large Lenses</td>
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<tr>
<td>DryEye</td>
<td>Small Lenses</td>
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<tr>
<td>ReadingEnv.</td>
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</table>

Pt. Responses are averages of all patient responses to the lens evaluation form. Responses were on a scale of zero to five.
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<tr>
<th>Eyes</th>
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<th>K Initial Vert</th>
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<tr>
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<tr>
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<td>44.75</td>
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</table>
REFERENCES:


LENS EVALUATION FORM

Now that you have adapted to or rejected one of the pairs of contact lenses that we have dispensed to you, we would like you to fill out this brief evaluation form to help us compile our data. Please give your utmost consideration to the first question as it is the main concern of our study.

GRADING SCALE

Circle the appropriate response using the following scale.

0 = Extremely poor
1 = Poor
2 = Less Than Average
3 = Average
4 = Better Than Average
5 = Excellent

1) Rate the comfort of the lens: 0 1 2 3 4 5
2) Rate ease of insertion: 0 1 2 3 4 5
3) Rate initial comfort: 0 1 2 3 4 5
4) Rate vision clarity: 0 1 2 3 4 5
5) Rate vision with respect to flair (If present): 0 1 2 3 4 5
6) Rate how well the lens remained centered: 0 1 2 3 4 5
7) Rate discomfort due to dry eye (If present): 0 1 2 3 4 5
8) Rate lens in a reading environment: 0 1 2 3 4 5
9) Rate lens in an active
10) Rate problems with foreign particles (If present):

11) Rate ease of removal:

12) Rate ease of cleaning:

13) Rate clinicians:

Print your name: ____________________

Please return to Alan Beckman or Scott Armer

Thank you for your help.
INFORMED CONSENT

Institution
A. Title of project: A Comparison of “Small” Versus “large” Diameter Rigid Gas Permeable Fitting Philosophies.
B. Principal Investigators: Scott Armer 359-4905
Alan Beckman 357-7650
James E. Peterson 357-0442
C. Advisor:
D. Location: Pacific University College of Optometry Forest Grove, O.R.
E. Date: 1991

1. Description of project
This project will compare the small and the large diameter contact lens fitting philosophies when prescribing rigid gas permeable lenses. We wish to investigate which fitting philosophy will result in a more comfortable contact lens fit. Subjective response will be used as a means for comparison.

2. Description of Risks
There may be a slight possibility of the following complications; mild discomfort, dry eye, burning, itching, tearing, vision blur, corneal abrasion, corneal/conjunctival or light sensitivity. Any of these complications may result in discontinued use of the contact lenses.

3. Description of Benefits
Each subject who completes this study will receive a complete fitting and the preferred pair of contact lenses.

4. Alternatives Advantageous to Subjects
Not applicable

5. Confidentiality
Records of this project will be maintained in a confidential manner and no name-identifiable information will be released. A number/name record will be kept of the photodocumentations, and will be destroyed at the end of the project.
6. Compensation and Medical Care
   If you are injured in this experiment it is possible that you will not receive compensation or medical care from Pacific University, the experimenters, or any organization associated with the experiment. All responsible care will be used to prevent injury however.

7. Offer to Answer Any Inquiries
   The experimenters will be happy to answer any questions that you may have at any time during the course of the study. If you are not satisfied with the answers you receive, please call A.R. Reinke at 357-3400. During your participation in the project you are not a Pacific University clinic patient or client for the purpose of the research and all questions should be directed to the researchers and/or the faculty advisor who will be solely responsible for any treatment (except for an emergency). You will not be receiving complete eye, vision, or health care as a result of participation in the project; therefore, you will need to maintain your regular program of eye, vision, and health care.

8. Freedom to Withdraw
   You are free to withdraw your consent and to discontinue participation in this project or activity at any time without prejudice to you.

I have read and understand the above. I am 18 years of age or over (or this form is signed for me by my parent or guardian.)
Print name__________________________________________________

Signed_________________________ Date_________________________

Address________________________ Phone________________________

City___________________________ State/Zip______________________
Name and address of a person not living with you who will always know your address.
I. Project Title
A Comparison of “Small” Versus “Large” Diameter Rigid Gas Permeable Fitting Philosophies.

II. Abstract
Our literature research has shown there to be at least two schools of thought when fitting rigid gas permeable lenses. The large philosophy claims decreased glare, increased patient comfort, and with the advent of high Dk material less edema and corneal distortion. The small interpalpebral philosophy claims less potential for prescription change, decreased corneal pathology, and better centration.

The purpose of the study is to compare the small and the large diameter lens fitting philosophies when prescribing rigid gas permeable lenses. We wish to investigate which fitting philosophy will result in a more comfortable contact lens fit. Subjective response will be used as a means for comparison.

III. Location of Project
Pacific University, College of Optometry Clinic facilities will be used to conduct this study.

IV. Project Overview
Our study will use ten Pacific Optometry students with no current ocular pathology. Corneal toricity will be limited to one diopter. All patients will have had a comprehensive exam prior to the fit evaluation, and will receive a complimentary pair of lenses. The lens material used will be SGP-3 and will be provided complimentary by Opti-Con. Our “small” contact lenses will have diameters below 8.5 mm, and our “large” lenses will have diameters above 8.5 mm.

At the initial examination each subject will be fit with “large” the subjects will receive “small” lenses, and the other half will receive “large” lenses. This choice will be made at random. Each subject will be evaluated at one week, and comfort will be assessed after a minimum of three weeks wear. Each subject will then be dispensed the alternate diameter lenses. The subjects will once again be followed in the same manner. Each
subject will be given their preferred lenses. A fluorescein pattern will be used to evaluate fitting characteristics. A comfort scale will be used to determine which diameter lens is preferred by the subject.

V. Risks

This study has the possibility of the following complications:
- mild discomfort
- burning, itching, tearing
- dry eye
- corneal abrasion
- vision blur
- change in shape of the optical elements of the eye
- neovascularization
- corneal/conjunctival inflammation
- light sensitivity

VI. Procedures to Control Risks

Each subject will be given lens instructions regarding use and care of the contact lenses prescribed. The procedure used will be the regular procedure for any contact lens patient. If any complications occur, lens wear may be discontinued.

VII. Other Pertinent Information
None

VIII. Signatures

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Scott Armer, Optometry Student

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Alan Beckman, Optometry Student

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Dr. James Peterson, Faculty Advisor
IX. Current Project Dates

November 21, 1990
Current Date

February 1991 - April 1991
Project Dates