A SUBJECTIVE COMPARISON OF QUALITY OF VISION THROUGH FOUR OPHTHALMIC MATERIALS

by

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ABSTRACT

Background: Many types of ophthalmic materials are available for use as corrective spectacle lenses. Each material has certain qualities that can be seen as advantageous when compared to other materials. A study of subjective ability to discriminate between the optical qualities of different lens materials may aid in marketing, help distribute higher quality materials to consumers, and convince professionals of the need to offer these materials. *Methods:* Lenses made of CR-39, polycarbonate, 1.6 index plastic, and Trivex materials were distributed amongst four stations divided by lens powers and working distances. Undergraduate college students were asked to rank the lenses from best quality of vision to worst at each station. Participants were also asked opinion-based questions as to their preferred lens, willingness to pay extra for that lens, and the importance of having material options offered at the time of spectacle purchase. *Results:* Significant lens preferences were found primarily at stations of +/-2.50 D. There was little consistency between stations and no difference found in rankings or preferences when data grouped by sex and by the initial instructions received was compared. The majority of participants did not agree that explanation of material differences is warranted at the time of lens choice, but were willing to pay extra for their preferred lens. *Conclusions:* Optical quality differences were not significantly observed at powers less than or equal to +/-1.50 D. This knowledge will help gear the marketing and sale of ophthalmic materials toward meeting each patient's specific needs without unnecessary explanations or overwhelming numbers of options.

TABLE OF CONTENTS

LIST OF TABLES

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INTRODUCTION

Many types of ophthalmic materials are available for use as corrective spectacle lenses. Each material has certain qualities that can be seen as advantageous when compared to other materials. The prescribing doctor, the optician, and the consumer have the task of weighing the benefits and drawbacks of each type of material to suit the patient's needs. The main characteristics examined when choosing modern lens materials include weight, thickness, impact resistance, reflectivity, off-axis vision, and cost.[1,2] A higher index of refraction leads to thinner lenses and higher reflectivity. Lower abbe values are an indication of decreased off-axis vision, and higher density and greater thickness lead to increased weight. Some intrinsic properties of a lens material can be modified with coatings or lens design; for example, reflectivity can be countered with antireflective coatings, but this adds to the cost. Weight and thickness concerns in high-powered prescriptions can be decreased with aspheric lenses and smaller frame size, but relative weight and thickness among the various materials remains constant.

Due to these many variables, the task of choosing an appropriate lens material for each patient can become a difficult and time-consuming endeavor. The benefits of offering and explaining material options to patients requiring high-powered or protective lenses are generally accepted due to experience with patient complaints of decreased off-axis vision and thick heavy lenses; however, for prescriptions of lower power, it may not be as beneficial to offer every consumer specialty lens materials.[2,3] Educating the consumer on the availability and benefits of different materials is not only time-consuming, but the patient may end up purchasing a more expensive lens without being able to notice any improvement in their subsequent spectacles. This study attempts to ascertain whether or not differences in lens materials made into low-powered lenses were large enough to warrant the marketing and sale of these products. Additionally, results from a study of subjective ability to discriminate between the optical qualities of different lens materials may aid in marketing, help distribute higher quality materials to consumers, and convince professionals of the need to offer these materials.

The materials examined in this study include CR-39, Trivex, polycarbonate, and SOMO 1.6 (high index) plastic. Specific properties of all four materials can be found in Table 1. CR-39 is the least expensive of the four materials. It has the highest abbe value and the lowest refractive index; both these factors imply high optical quality. CR-39 makes a good, inexpensive lens with few off-axis aberrations and low reflectivity, but can be thick and relatively heavy with higher powers and does not possess the impact resistance potential found in other materials. Polycarbonate is a lens that has been refined since its introduction in 1980 to be a more clear homogenous material.[4] This moderately expensive lens is thinner and lighter for higher powers, but has lower optical quality due to its off-axis aberrations and higher reflectivity. Its primary advantage is its superior impact resistance, making it ideal for children, monocular patients, athletes, rimless frames, and for any other patient desiring protective lenses. Trivex is a relatively new material (available since 2001 from PPG Industries) and is more expensive than CR-

39 and polycarbonate. It was designed to combine the advantages of CR-39 and polycarbonate by offering good optical quality, excellent impact resistance, and relatively low reflectivity. In addition to being more expensive, Trivex is also thick and relatively heavy with higher powers. Higher index materials such as 1.6 plastic are designed to address issues of thickness and weight in high-powered prescription lenses. These lenses are thinner and lighter but offer only moderate impact resistance, fair optical quality, and can have high reflectivity and increased cost.[3,5]

	CR 39	Polycarbonate	1.6 index plastic	Trivex
Abbe Value	58	29	42	46
Impact Resistance	Fair	Excellent	Fair	Excellent
Density (g/cm^3)	1.32	1.22	1.35	1.11
Refractive Index (n)	1.498	1.59	1.6	1.532
Surfacing Ability	Excellent	Poor	Good	Good
Tinting Ability	Good	Very Poor	Good	Excellent
Cost	Low	Moderate	Moderate	High

Table 1: Properties of Ophthalmic Lens Materials[5,6]

The weight and thickness of various materials are fairly easy qualities to explain to a consumer and can be described in terms of percentages of a known quantity. Also, it can be shown quantitatively that in lenses of low powers the difference in weight and thickness between materials is negligible. Material choices made based on cost and impact resistance are usually related to the patient's personal needs or ability to pay, and are often more straight-forward decisions. Optical quality is not easily quantified, and is often an unfamiliar concept to consumers and must be described by the prescribing doctor or optician. The seller must also explain the importance in an applicable way to the consumer. Off-axis vision has been assessed directly through two materials of different abbe values and indirectly with the experience of sellers and unhappy customers. These combined observations suggest that poorer optical quality, measured by reflectivity and chromatic aberration, is significant in higher powers for many patients.[2,3]

Reflectivity is directly related to the index of refraction of a material. As the index of refraction increases, so does the reflectivity. This can be bothersome to a person because with high reflectivity there may be a faint reflection of the person's face on the back side of the lenses and decreased contrast through the lenses.

Chromatic aberration produces chromatic phase shifts and subsequent loss of luminance contrast which leads to reduced visual acuity. In other words, when white light passes through a lens that produces chromatic aberration, the various wavelength components of the light are dispersed rather than focused to a discrete point. This leads to the appearance of colored fringes around objects or reduced contrast. The effect of chromatic aberration is greater farther from the optical center of a lens and is proportional to the prismatic power of the point where it passes through. Therefore chromatic aberration is most noticed in the periphery of higher-powered lenses.[3]

In a previous study by Hampton et al, visual acuity through incremental prisms made from polycarbonate and CR-39 showed that at 3 prism diopters there was approximately 0.5 lines of acuity lost through polycarbonate and no loss through CR-39. By 6 prism diopters, 1.25 lines of acuity were lost with polycarbonate and barely 0.25 lines with CR-39. At 14 prism diopters the effect was more dramatic with 3 lines lost through polycarbonate and only 1 through CR-39.[3] This supports the idea that for high powered lenses, peripheral vision is greatly affected by dispersion, but for lower powered lenses the effect is less and maybe not even noticed by the subjective viewer. There is some disagreement as to the amount a normal person turns their eyes to look at something before they will turn their head. The degrees vary and translate to distances on the lens of 0.4 to 1.3 cm horizontally and about 0.6 to 1.0 cm down while reading.[3] According to Prentice's Rule, for a 2.50 D lens 2 cm from the optical center, the prismatic power should be 5 prism diopters, and for a 1.50 D lens 2 cm from the optical center the prismatic power should be 3 prism diopters. Looking through polycarbonate, this would then reduce visual acuity by 0.75 lines and 0.5 lines, respectively, and there would be virtually no reduction in acuity through a CR-39 lens.

Based on the above evidence, it seems necessary to explore whether or not optical quality differences are subjectively significant in lower powers. In this experiment, four different materials were provided to participants in lenses of low powers to attempt to determine if human subjects would prefer the optical quality of one material over another. The difference in chromatic aberration and resulting optical quality was examined to see if it was trivial enough in low power lenses that the materials would be indiscernible from one another to the average consumer. If differences are significant, questions arise in the dispensing of materials relating to compromises between optical quality and other properties; for example, if a material with high impact resistance is found to have poor subjective optical quality, it may not be appropriate to offer this material to a patient not requiring specific impact standards. Conversely, if differences are minimal, other properties of lens materials may be emphasized to consumers without fear of subsequent spectacle rejection due to poor optical quality.

METHODS

Round lens blanks made of polycarbonate, CR-39, 1.6 index plastic, and Trivex materials were used in the powers of +2.50 D (station 1), +1.50 D (station 2), -2.50 D (station 3), and –1.50 D (station 4) with the lenses at each station randomly laid out and labeled only "A" through "D". Volunteers were recruited from the undergraduate student population of Ferris State University in Big Rapids, Michigan. Of the 88 participants, 47 were female and 41 were male. Ages ranged from 18 to 38 years, with a mean age of 20.3, standard deviation of 4.02, mode of 18, and median of 19 years. Mean visual acuity was 20/21.2 with a mode of 20/20 and median of 20/20; students with acuities of worse than 20/40 were excluded from the study. Volunteers were allowed to be wearing contact lenses but were not allowed to wear spectacles so as not to contaminate the study with compounding optical imperfections of their own lenses.

Participants were randomly divided into two groups, differing only in the instructions they received to evaluate the lenses. Explanations were not given to 47 participants as to what to look for while evaluating the lenses and 41 were given explanations. The first group was told to look for differences in their quality or crispness of vision without further definition. The second group was told that the best lens should be the lens that provides a more natural view of the target, and to consider aspects such as colored fringes around edges of letters or objects, distortions, and their personal comfort while looking through each lens. The two groups were allowed to flow through the same stations. At each station, the participants wore their best non-spectacle correction if required, looked monocularly (one eye being covered) through individual lens blanks, ranked them in order from #1 to #4 (with #1 having the best subjective optical quality of vision) and then indicated the lens they most preferred. If they were unable to tell a difference between some or any of the lenses, they were instructed to give their best estimate, making this a forced choice test. When looking through the plus lenses, patients were instructed to read high and low contrast print material of Times New Roman font of varying sizes (representing the varying sizes of news print). When looking through the minus lenses, subjects were instructed to look around the room and at a distance acuity chart that was posted on the wall.

After ranking the lenses and choosing a preferred lens, two questions were asked in order to gather further subjective opinions on the differences between materials, and were as follows: 1) "In your opinion, was there enough of a difference between the lenses to warrant explaining and offering different lens materials to all prospective consumers?" And 2) "If purchasing a pair of glasses, would you pay extra for the increased quality of vision of your number one lens?" Participants were instructed to handle lenses carefully by the edges so as not to make smudges on the lens, lens cloths were provided at each station, and lenses were periodically examined to ensure their cleanliness.

RESULTS

Data analysis was done using the chi-square test for independence of variables and z-tests for proportions with a level of significance of $a = 0.05$. According to the chi-square analysis, there was a significant relationship between lens materials and their subsequent optical quality ranking at three stations: station 1 (+2.50 D, $p = 0.0473$), station 3 (-2.50 D, $p = 0.0011$), and station 4 (-1.50 D, $p = 0.0016$). No relationship was found at station 2 (+1.50 D). This test does not elicit the exact relationship between variables, it simply indicates whether or not one exists.

In order to define more specifically the relationship between materials and ranking, z-tests for proportions were utilized. Beginning with station 1 (+2.50 D), CR 39 material was ranked first significantly more than chance probability would predict ($p=.0489$). Also, 1.6 plastic was ranked as fourth consistently ($p=.0267$). No other lens material was ranked in a certain order more than chance probability would expect. At station 2 (+1.50 D), the only significant finding was that Trivex was ranked third ($p=.0411$) more than any other rank. Station 3 (-2.50 D) produced the most substantial findings: the order of lenses was significant for all four ranks. The lens ranked most frequently as number one was Trivex ($p=.0489$), polycarbonate ranked second ($p=.0138$), 1.6 index plastic ranked as third ($p=.0138$), and CR-39 ranked fourth ($p=.0068$). In addition to the 1.6 index plastic's rank as third, it was also significant in that it was consistently not ranked number 1 ($p=.0267$). At station 4 (-1.50 D), Trivex was ranked as the number 2 choice ($p=.0146$), but other lens materials were not ranked in a significant order. The probability values (significance) of the ranking of all lenses at all stations are shown in Appendix A. Individual rankings for all lenses can be found in Appendix B.

When relative lens rankings were examined using chi-square analysis, it was found that no lens significantly ranked higher than another at any station except for Trivex being ranked higher than 1.6 plastic at station 4 ($p=.026$). However, there were some trends evident and fairly consistent through the stations. CR-39 was generally ranked higher than Trivex and 1.6 plastic. Trivex was ranked higher than polycarbonate and 1.6 plastic. Polycarbonate was ranked higher than 1.6 plastic. Values for relative rankings can be found in Appendix C.

In response to being asked to choose a preferred lens, there was no significant leading material choice at any station. CR-39 came in first at station 1 with 25% of participants choosing it as their preferred lens. Station 2 leading preferences were split between 1.6 index plastic (25%) and no preference at all (25%). Trivex was preferred by 31% at station 3 and 29% of participants chose no preference at station 4 (Appendix E). When asked if they thought hearing an explanation of different lens materials when purchasing lenses was worth their time, participant responses were similar at all four stations: the majority of votes were "no", with the strongest response at station 4 (55%, 53%, 52%, 62%, in order of stations 1 to 4). Stations 1 through 3 were split evenly and uniformly between "yes" and "no" answers (Appendix E). Interestingly, however, when asked if they would pay extra to have the lens material that they preferred when ordering, the majority of responses at stations 1 and 2 were for "yes" (53% and 50%), and the highest percent vote at stations 3 and 4 was for "yes" also (44% and 43%) (Appendix F).

Data was analyzed by comparing rankings and responses to questions of males versus females, and of the groups differing in whether or not they heard explanations of what to look for when evaluating lenses. Trends in these comparisons are shown in Appendices F through I. The only statistically significant finding was at station 3: Trivex was ranked higher by males than by females ($p=.0246$). No difference was found at other stations in male/female ranking or preferences, or in the explained/not explained groups.

Lastly, it is also worth noting that consistency across all 4 stations for each participant was very low. In other words, it was rare for any participant to rank the same material as their favorite or highest/lowest ranked lens at all four stations. Variability was high in this respect.

DISCUSSION

From our results it is difficult to conclude that optical quality differences are always discernible between lens materials made in low powers. With lenses in the power of +2.50 D, CR-39 was chosen as the #1 ranked lens and 1.6 index plastic was chosen as the #4 ranked lens consistently and significantly. Only in the power of –2.50 D did the lenses fall into a specific order of subjective optical quality. From this it is reasonable to suggest that explaining optical quality of different materials is valuable primarily in lenses of powers of +/- 2.50 D and above. Correspondingly, when choosing materials for their other qualities such as impact resistance or weight, caution should be taken by explaining possible resulting decreases or changes in visual quality at these powers as well. Below powers of +/-2.50 D, it remains uncertain and up to the prescribing doctor, optician, and consumer as to whether or not the benefits and drawbacks of certain materials are applicable to the patient's needs and worth taking the time to explain.

Of the specific materials, CR-39 performed as expected based on its high abbe value and low index of refraction, ranking significantly higher than other materials, but only with lenses of power +2.50 D. Surprisingly, CR-39 placed last in subjective quality of vision at the station of lens power –2.50 D. The reason for this is unknown. Lenses made of 1.6 index plastic ranked lower than polycarbonate at multiple stations despite the higher abbe value of this material. The slightly higher index of refraction and resulting reflectivity of 1.6 index plastic may be the reason for this finding. Based on this data, patients desiring the thinnest lenses at lower powers may not necessarily benefit overall from higher index lenses, and should consider using the lighter Trivex material or the similar in refractive index polycarbonate instead. Trivex performed consistently in the middle of the rankings, without being chosen as the best or worst lens at any station. This indicates that the use of Trivex as a replacement for other lens materials when both good optical quality and impact resistance are desired will likely continue to increase, although the cost of this material prevents it from becoming the most popular material for low powers any time soon. Polycarbonate did not show any significant trends in ranking. The lack of a consistently lower ranking for polycarbonate indicates good tolerance at the powers examined therefore its importance as an inexpensive, impact-resistant lens is unlikely to change.

While the responses to the opinion questions were not strongly significant, it was still interesting to note that even though the majority of participants did not think it worth the time to hear explanations for each type of material, they were still willing to pay extra for their preferred lens. This data serves to further stress the importance of the well-trained optician or doctor's ability to narrow the patient's choices down to only a few applicable materials before explanations are offered. The exact cost of each material was not provided in this study, however, and this factor could influence the participants' decisions as to their willingness to pay extra for their preferred lens. Analyzing the data by comparing groups divided by sex yielded no difference in rankings, preferences, or opinions at any station that is applicable to the market and sale of lens materials. Also, given that there was no difference in rankings or preference between the group without additional explanations at the start of the study compared to the group that was given explanations, it seems that explaining possible optical quality differences would not increase the sensitivity of patients to the performance of their lenses at these low powers.

Further study is needed as lens materials become more sophisticated and the needs and demands of the consumer change. A subjective evaluation of optical quality through a patient's precise spectacle prescription would likely give a more reliable result by eliminating the positive and negative accommodative demands required to see clearly through each lens; however, the cost of such a study would be considerable. A study specifically instructing the participants to look off-axis through the lenses, though not as natural as the instructions in this study, may have shown a higher sensitivity to chromatic aberration. In addition to this, a more varied population that includes children, presbyopic patients, those with less than 20/40 visual acuities and others not previously studied would expand the population to which this data is applicable.

In conclusion, the importance of assisting patients in choosing lens materials that will meet their needs cannot be overemphasized. Offering numerous choices that may not be seen as significantly different by the consumer is time-consuming and often unnecessary. The findings of this study indicate that in lens powers equal to and less than +/-1.50 D, optical quality differences are not as much a concern as they are in higher-powered lenses. However, many properties of different materials are worth explaining and may benefit the patient at any lens power; the prescribing doctor and dispensing optician have the responsibility of helping the consumer to make their choices.

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APPENDIX A

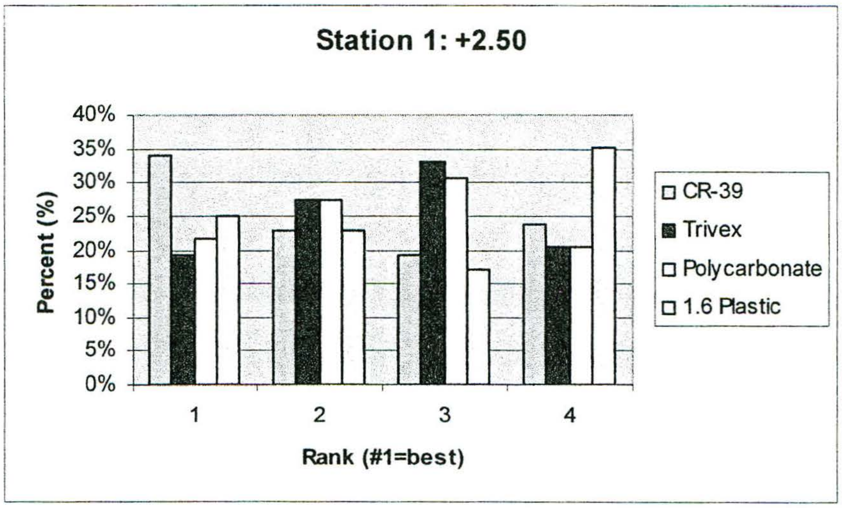
SIGNIFICANCE OF RANKINGS FOR ALL LENSES

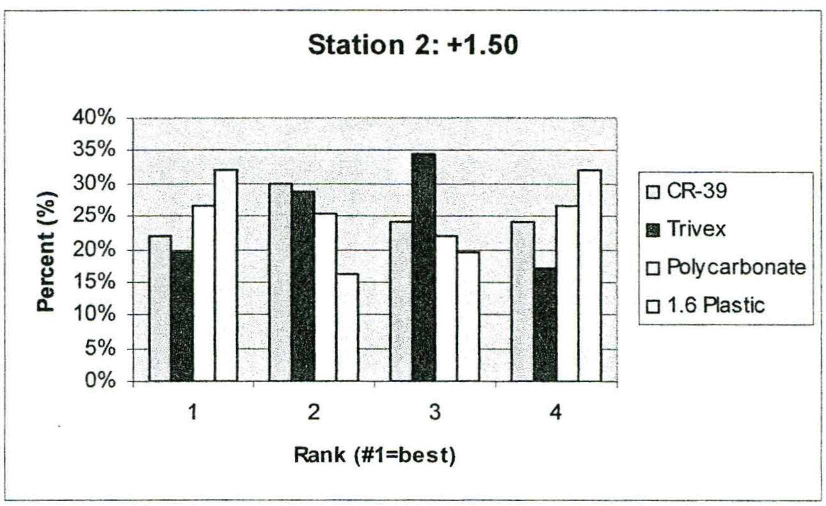
Station 1 (+2.50 D)					
	Rank	**CR39**	**Trivex**	**Polycarb**	**1.6 Plas**
Incidence	1	30	17	19	22
	2	20	24	24	20
	3	17	29	27	15
	4	21	18	18	31
p-values	1	**0.0489**	0.2184	0.4602	0.9999
	2	0.6225	0.6225	0.6225	0.6225
	3	0.2184	0.0848	0.2184	0.0848
	4	0.8055	0.3248	0.3248	**0.0267**

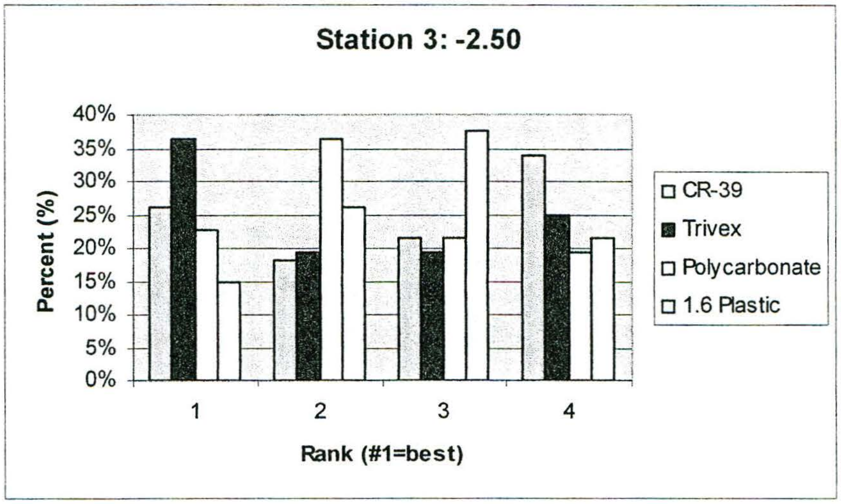
Station 2 (+1.50 D)					
	Rank	**CR39**	**Trivex**	**Polycarb**	**1.6 Plas**
Incidence	1	19	17	23	28
	2	26	25	22	14
	3	21	30	19	17
	4	21	15	23	28
p-values	1	0.4959	0.2396	0.7569	0.1218
	2	0.2927	0.421	0.9506	0.055
	3	0.8527	**0.0411**	0.4959	0.2396
	4	0.8527	0.0947	0.7569	0.1218

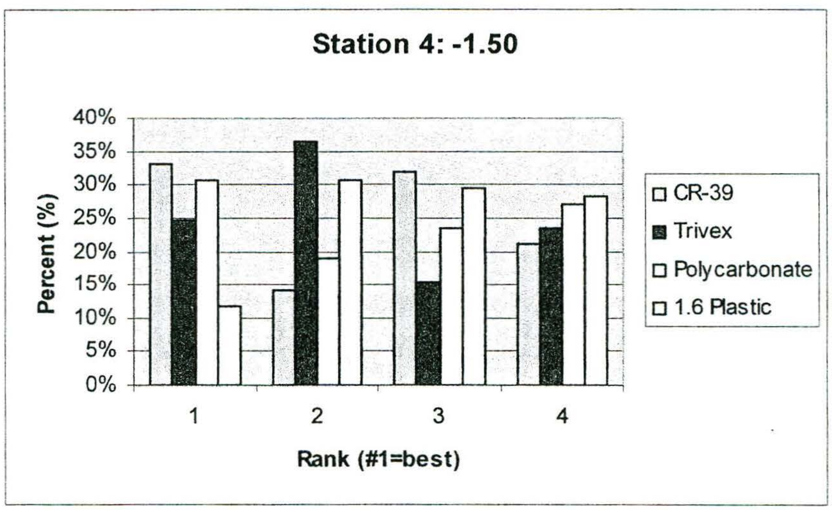
Station 3 (-2.50 D)					
	Rank	**CR39**	**Trivex**	**Polycarb**	**1.6 Plas**
Incidence	1	23	32	20	13
	2	16	17	32	23
	3	19	17	19	33
	4	30	22	17	19
p-values	1	0.8055	**0.0138**	0.6225	**0.0267**
	2	0.1396	0.2184	**0.0138**	0.8055
	3	0.4602	0.2184	0.4602	**0.0068**
	4	**0.0489**	0.9999	0.2184	0.4602

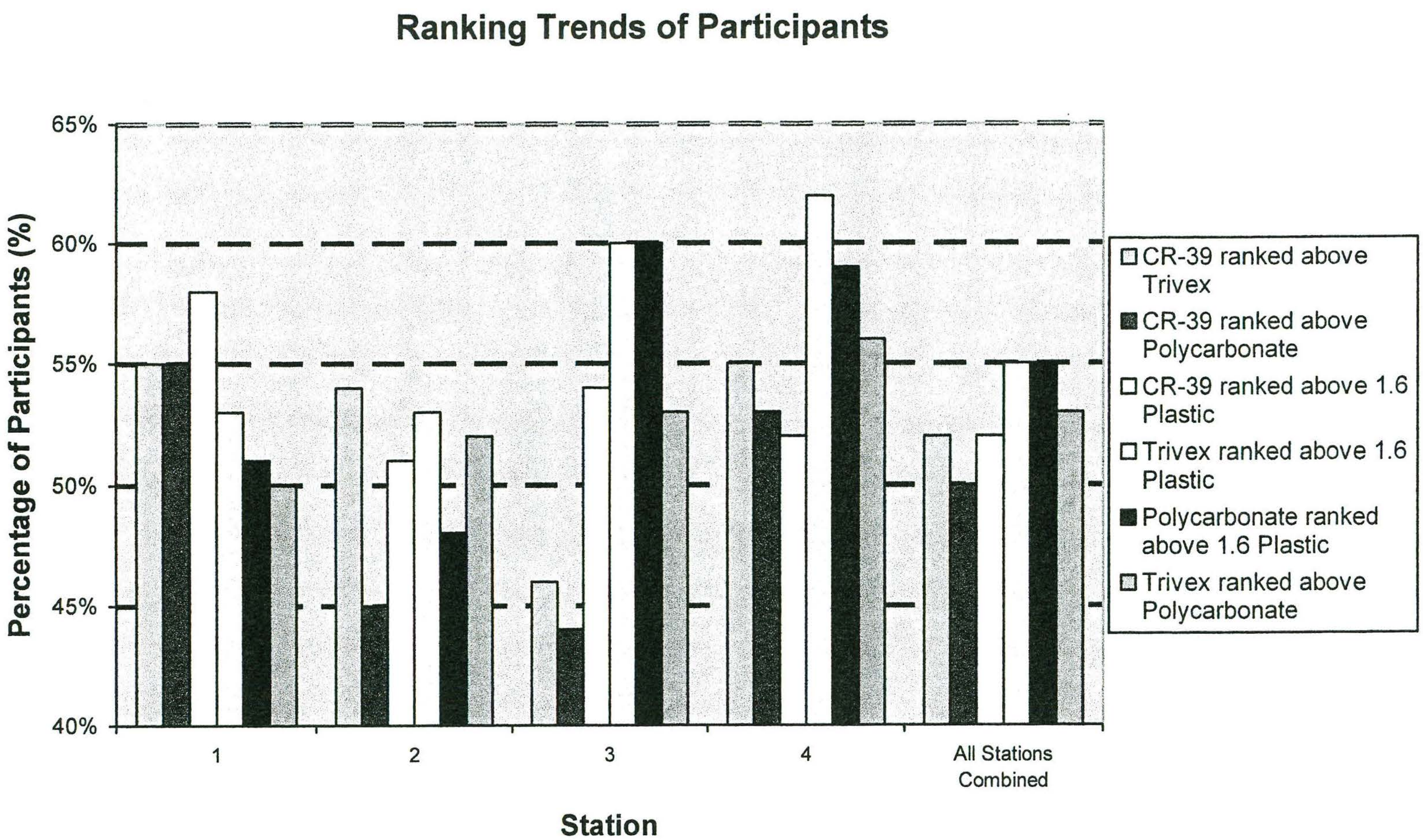
Station 4 (-1.50 D)					
	Rank	**CR39**	**Trivex**	**Polycarb**	**1.6 Plas**
Incidence	1	28	21	26	10
	2	12	31	16	26
	3	27	13	20	25
	4	18	20	23	24
p-values	1	0.0909	0.9501	0.2341	**0.0048**
	2	**0.0205**	**0.0146**	0.1884	0.2341
	3	0.1498	**0.0388**	0.7542	0.3476
	4	0.4156	0.7542	0.6611	0.4909

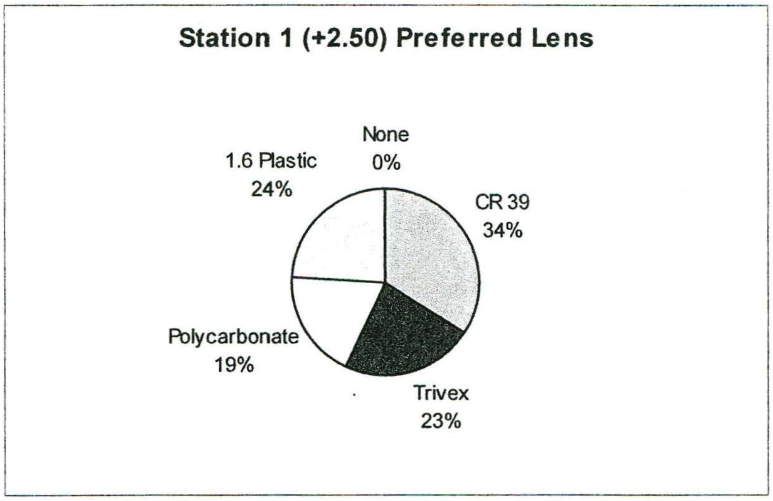

Station 1: +2.50
Percent (%)
40%
35%
30%
25%
20%
15%
10%
5%
0%
1
2
3
4
Rank (#1=best)
CR-39
Trivex
Polycarbonate
1.6 Plastic

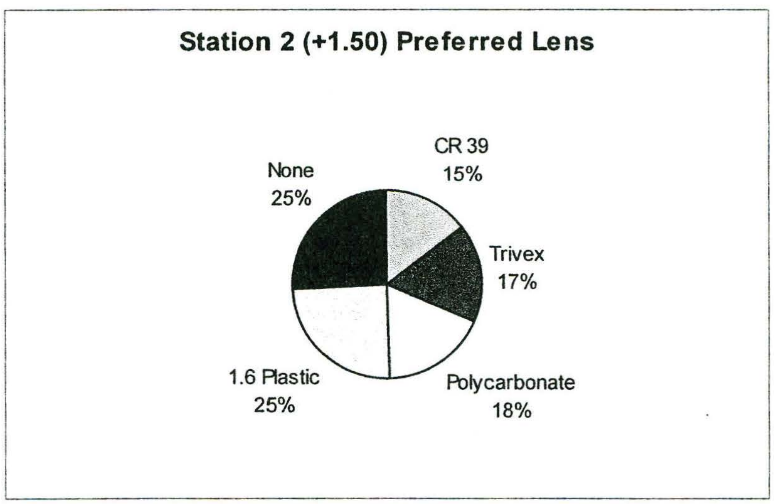

Station 2: +1.50
Percent (%)
40%
35%
30%
25%
20%
15%
10%
5%
0%
1
2
3
4
Rank (#1=best)
CR-39
Trivex
Polycarbonate
1.6 Plastic

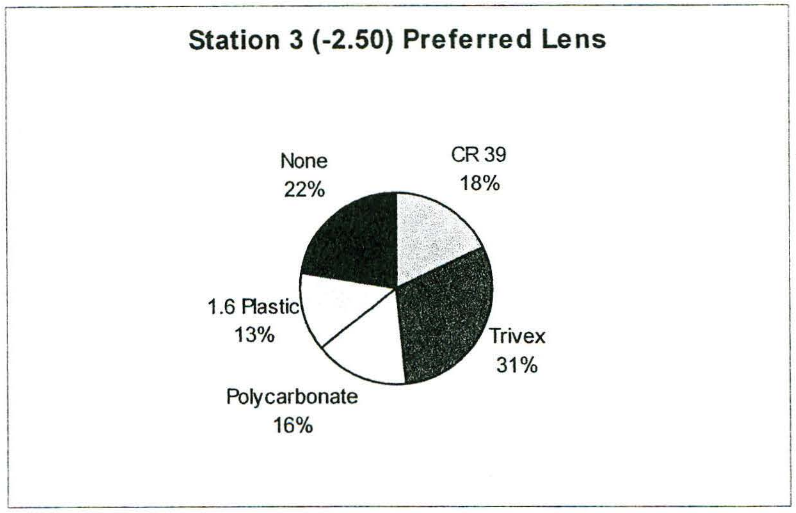

Station 3: -2.50
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percent (%)
1
2
3
4
Rank (#1=best)
CR-39
Trivex
Polycarbonate
1.6 Plastic

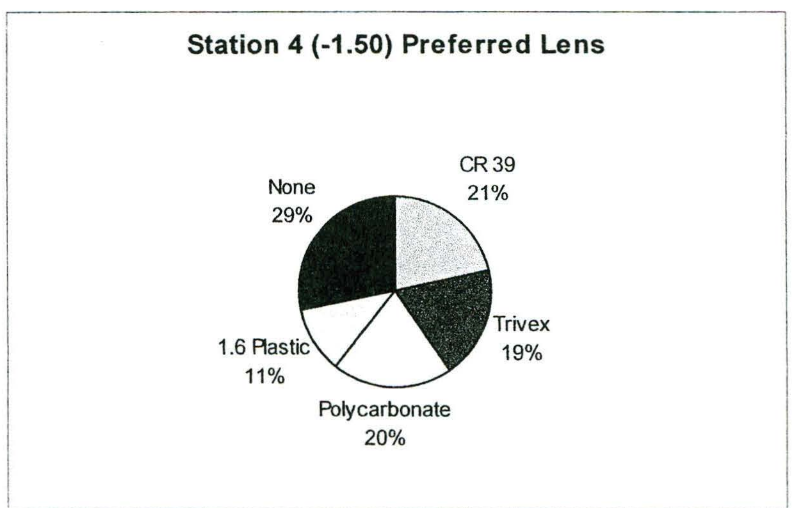

Station 4: -1.50
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percent (%)
1
2
3
4
Rank (#1=best)
CR-39
Trivex
Polycarbonate
1.6 Plastic

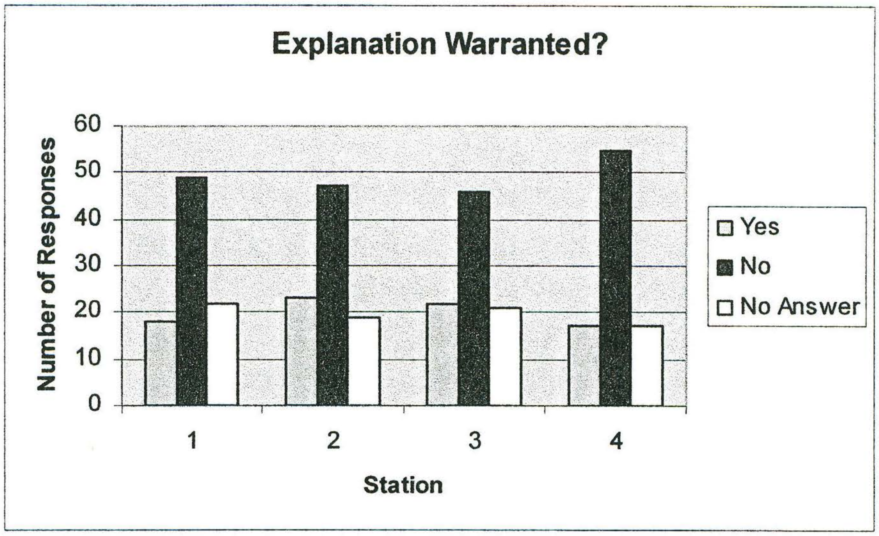

Ranking Trends of Participants
65%
60%
55%
50%
45%
40%
Percentage of Participants (%)
1
2
3
4
All Stations Combined
Station
CR-39 ranked above Trivex
CR-39 ranked above Polycarbonate
CR-39 ranked above 1.6 Plastic
Trivex ranked above 1.6 Plastic
Polycarbonate ranked above 1.6 Plastic
Trivex ranked above Polycarbonate

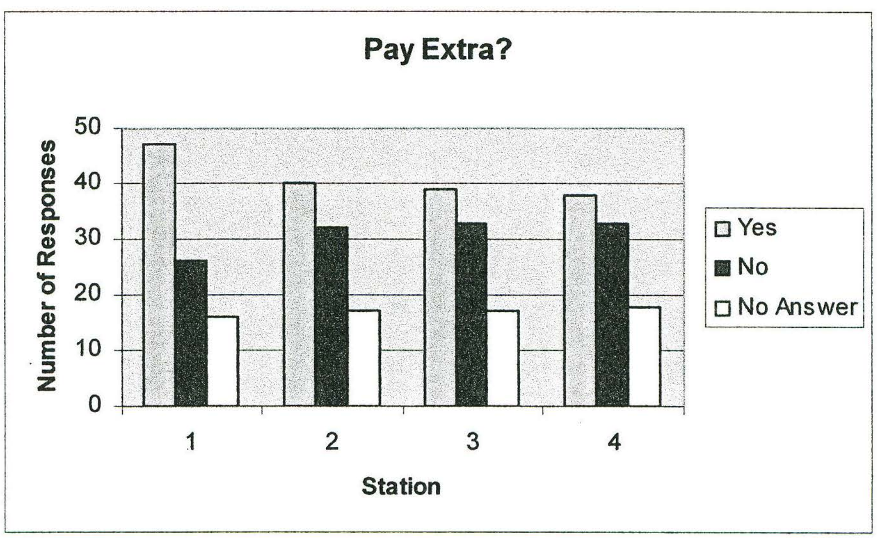

Station 1 (+2.50) Preferred Lens
None
0%
1.6 Plastic
24%
CR 39
34%
Polycarbonate
19%
Trivex
23%


Station 2 (+1.50) Preferred Lens
CR 39
15%
None
25%
Trivex
17%
1.6 Plastic
25%
Polycarbonate
18%


Station 3 (-2.50) Preferred Lens
None
22%
CR 39
18%
1.6 Plastic
13%
Trivex
31%
Polycarbonate
16%

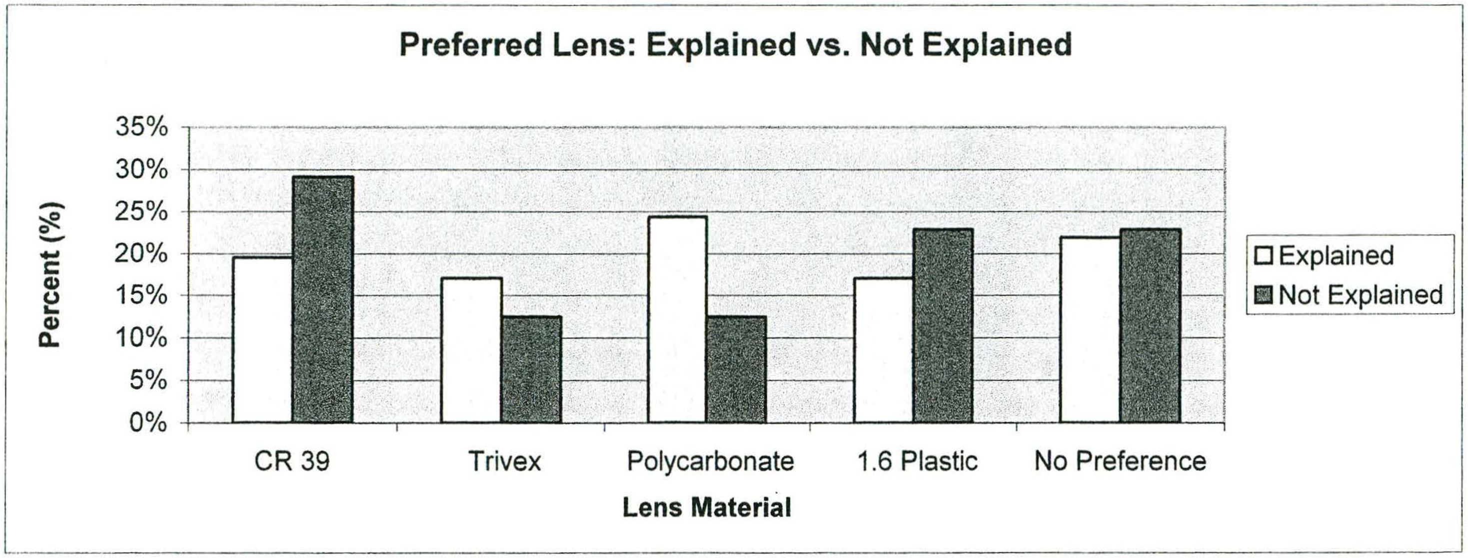

Station 4 (-1.50) Preferred Lens
CR 39
21%
None
29%
Trivex
19%
1.6 Plastic
11%
Polycarbonate
20%

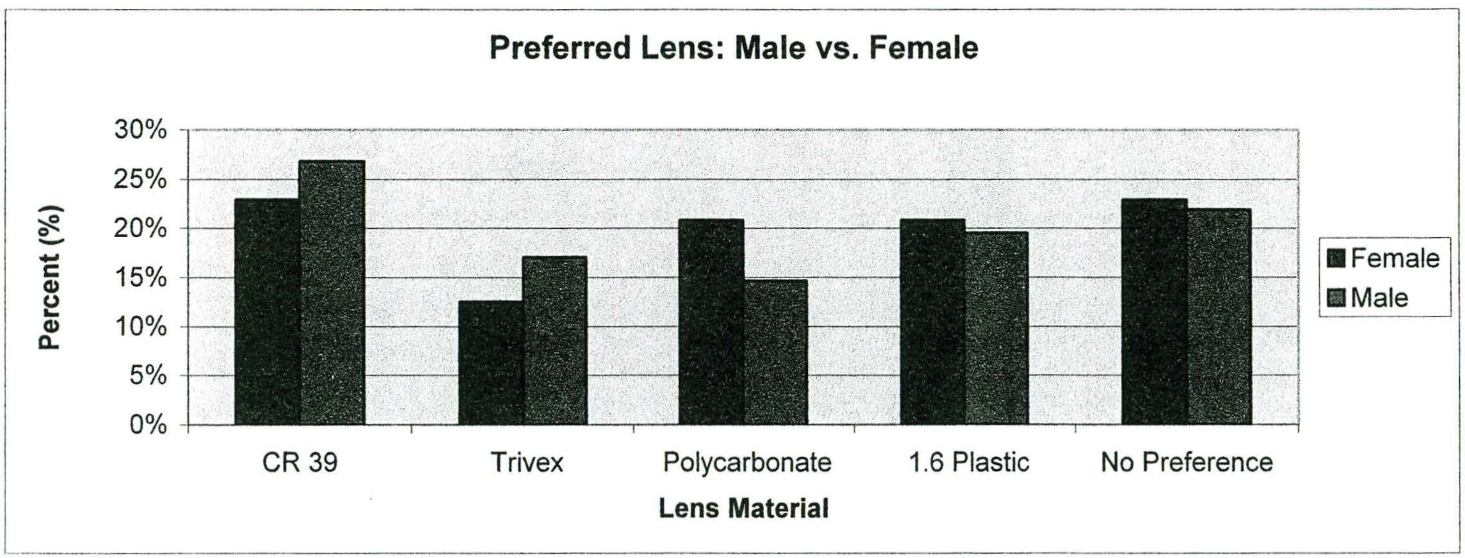

Explanation Warranted?
Number of Responses
60
50
40
30
20
10
0
1
2
3
4
Station
Yes
No
No Answer


Pay Extra?
Number of Responses
50
40
30
20
10
0
1
2
3
4
Station
Yes
No
No Answer

APPENDIX F

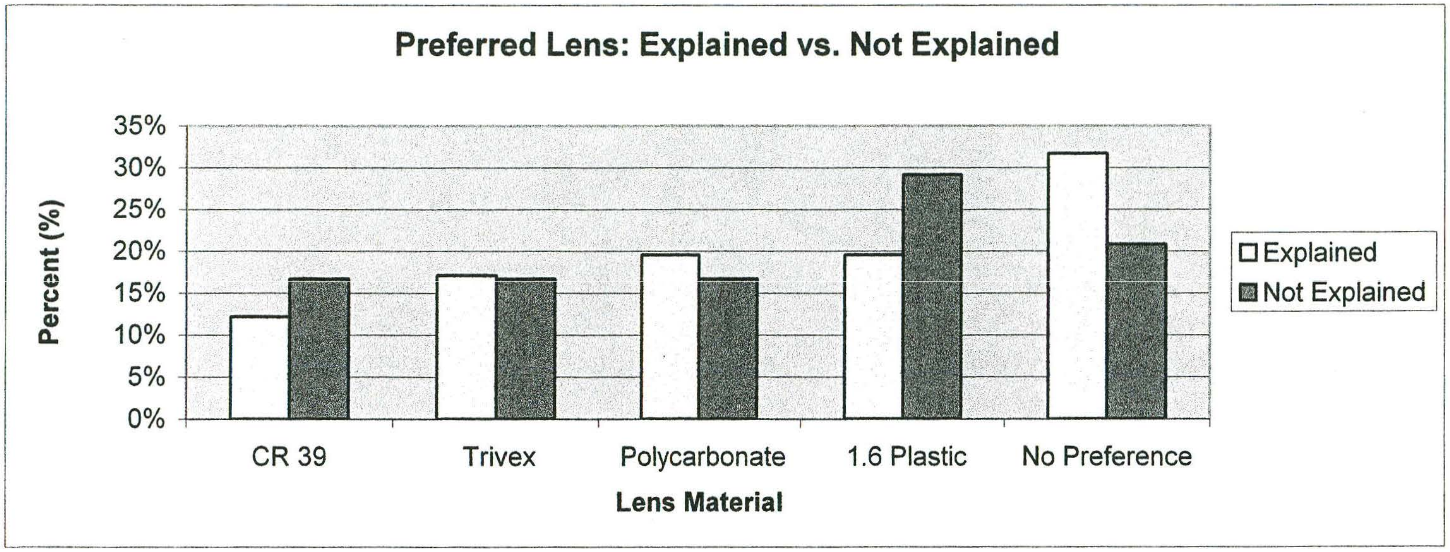
PREFERRED LENS AT STATION 1 (+2.50 D)

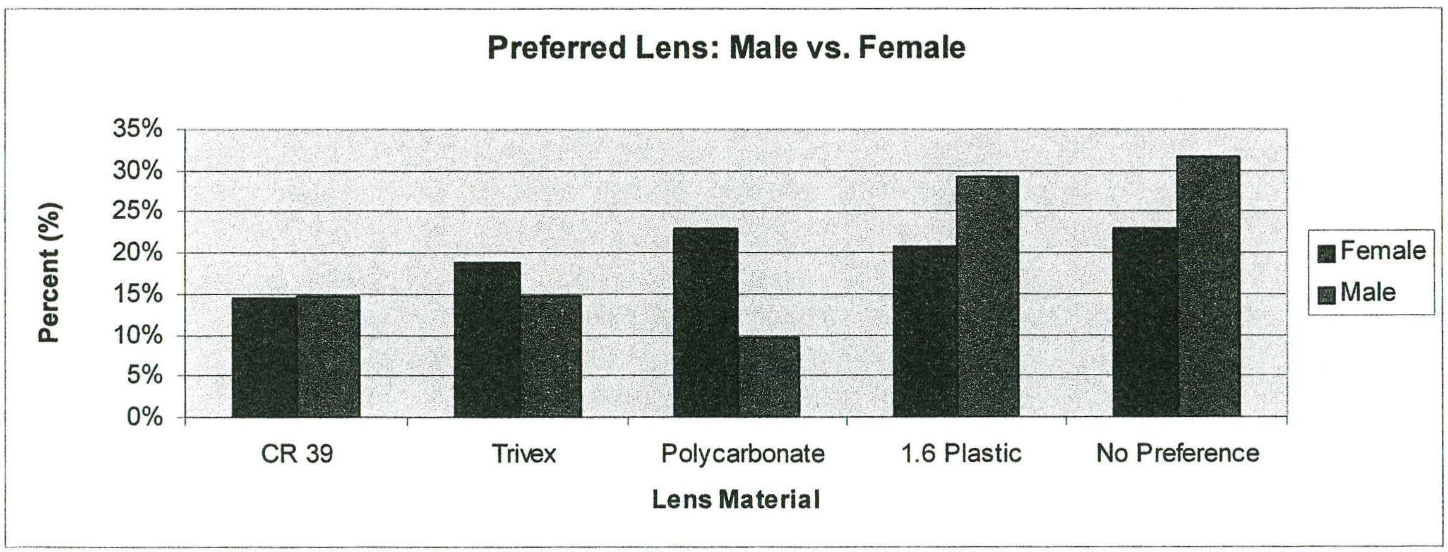

Preferred Lens: Explained vs. Not Explained
35%
30%
25%
20%
15%
10%
5%
0%
Percent (%)
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Explained
Not Explained


Preferred Lens: Male vs. Female
30%
25%
20%
15%
10%
5%
0%
Percent (%)
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Female
Male

APPENDIX G

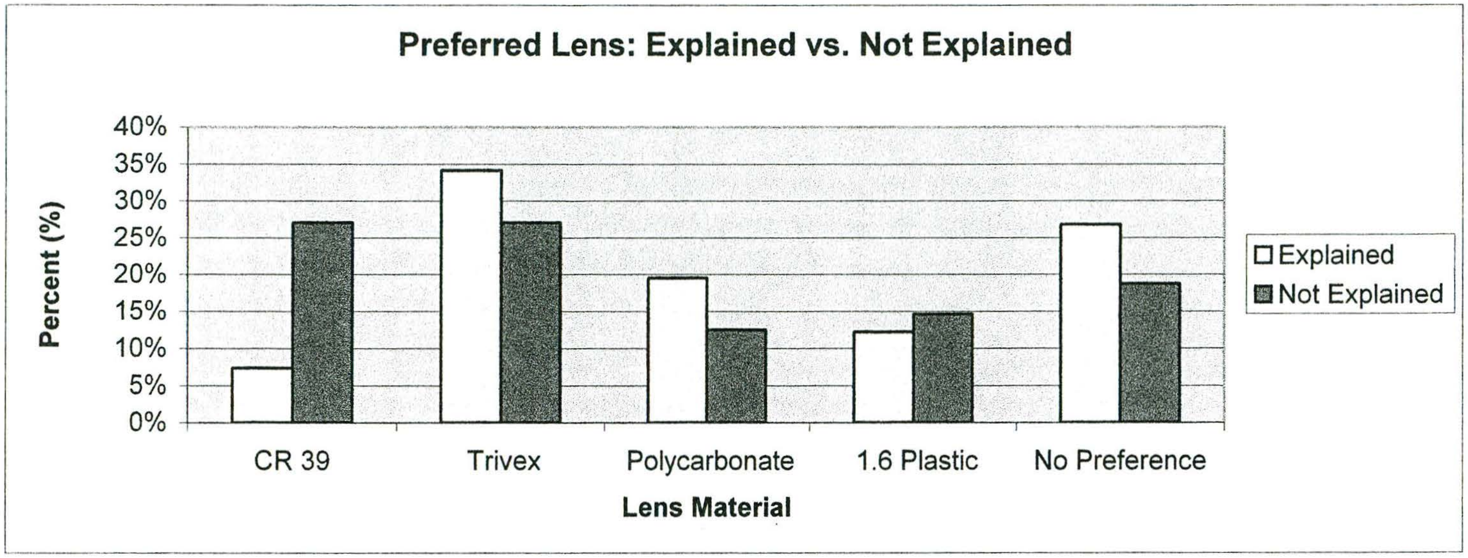
PREFERRED LENS AT STATION 2 (+1.50 D)

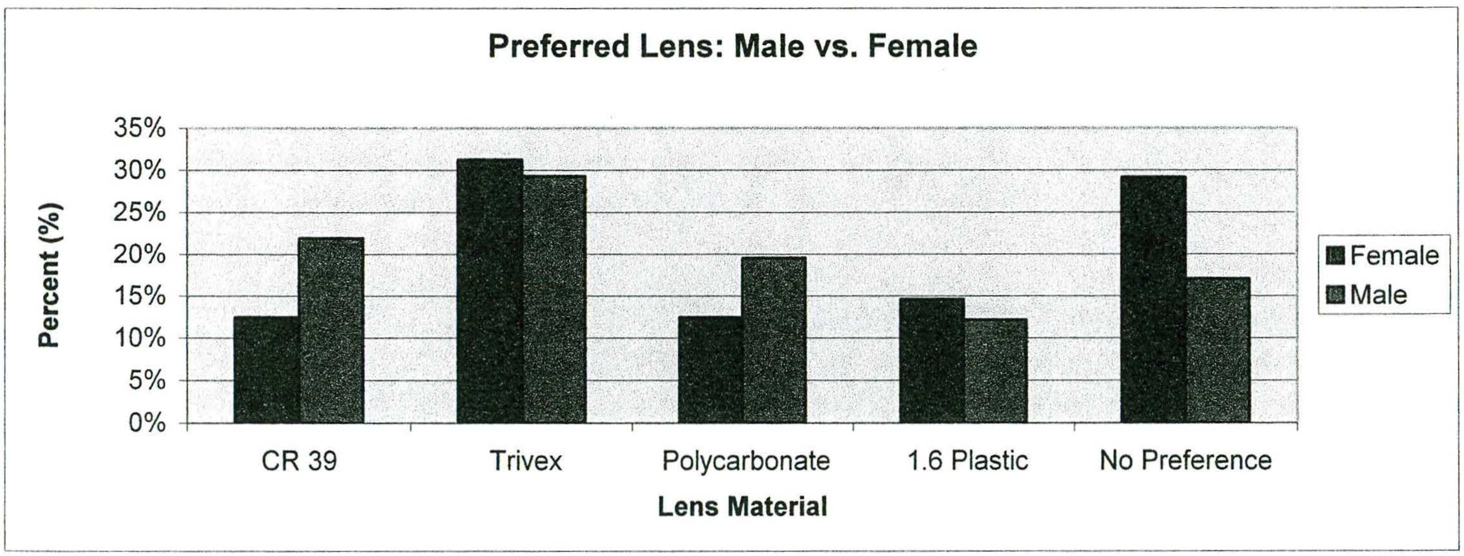

Preferred Lens: Explained vs. Not Explained
35%
30%
25%
20%
15%
10%
5%
0%
Percent (%)
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Explained
Not Explained


Preferred Lens: Male vs. Female
35%
30%
25%
20%
15%
10%
5%
0%
Percent (%)
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Female
Male

APPENDIX H

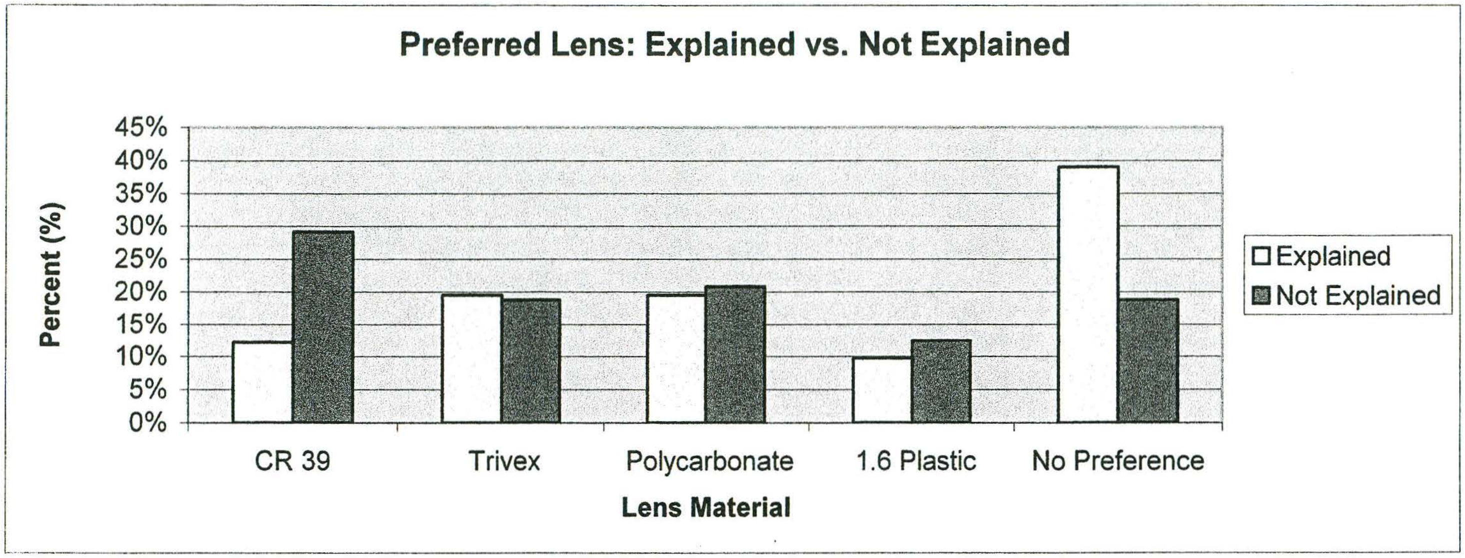
PREFERRED LENS AT STATION 3 (-2.50 D)

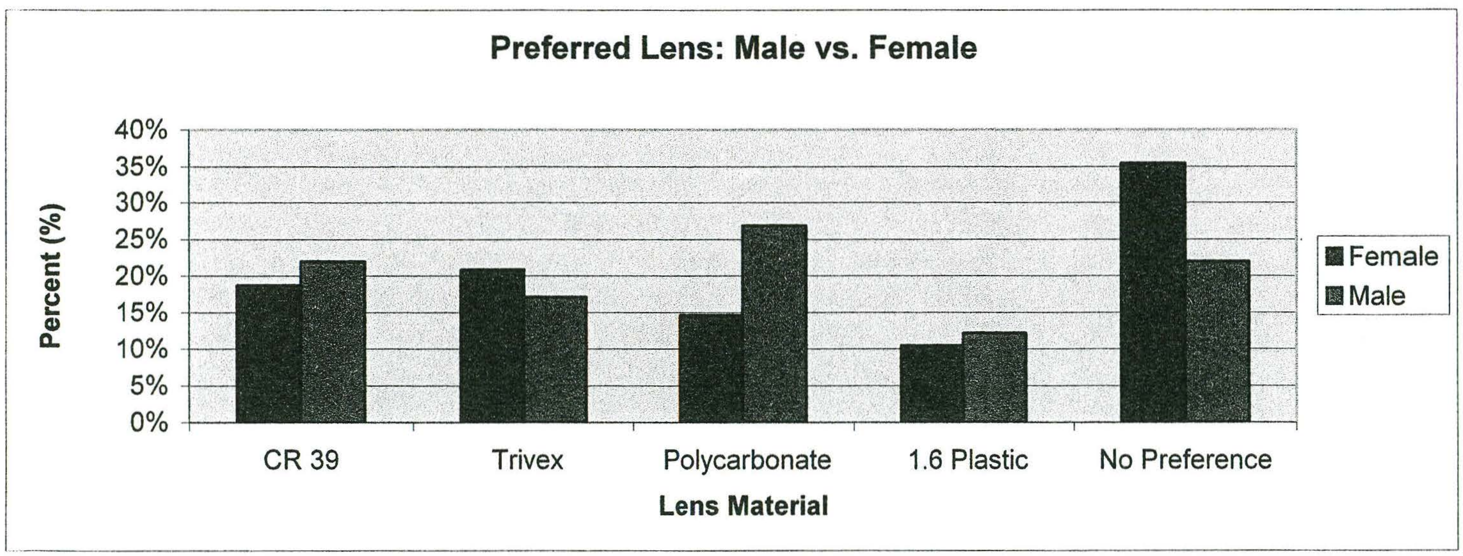

Preferred Lens: Explained vs. Not Explained
Percent (%)
40%
35%
30%
25%
20%
15%
10%
5%
0%
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Explained
Not Explained


Preferred Lens: Male vs. Female
Percent (%)
35%
30%
25%
20%
15%
10%
5%
0%
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Female
Male

APPENDIX I

PREFERRED LENS AT STATION 4 (-1.50 D)


Preferred Lens: Explained vs. Not Explained
Percent (%)
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Explained
Not Explained


Preferred Lens: Male vs. Female
Percent (%)
40%
35%
30%
25%
20%
15%
10%
5%
0%
CR 39
Trivex
Polycarbonate
1.6 Plastic
No Preference
Lens Material
Female
Male