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The effect of CDC recommended disinfecting solutions on Goldmann tonometer biprisms

Nada J. Lingel
Pacific University

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Abstract

Twelve new Goldmann biprisms were used to measure the intraocular pressure of the right eye of a single subject four times each day for fifteen days. Between measurements, nine of these biprisms were disinfected in the three solutions recommended by the Centers for Disease Control (CDC) as effective against the AIDS virus. The remaining three biprisms were disinfected by rubbing the biprism face with an isopropyl alcohol swab, a standard procedure in many clinical settings. The intraocular pressure measurements obtained using the four disinfecting regimens were compared to determine if any of the regimens influenced the results. At the time of measurement each biprism was evaluated to determine if any of the regimens affected the clarity of its front surface or the image of the Goldmann rings seen when performing the measurement. When comparing the clarity of the biprisms, those soaked in alcohol were found to be significantly different from all other groups, with all of the alcohol soaked biprisms being unusable after the fourth day. None of the other three disinfecting groups differed significantly from each other in regard to biprism clarity. Because the biprisms soaked in alcohol were unusable so early in the study, they were not used in the statistical analyses of IOP measurement and biprism image quality. No clinically significant difference was found in intraocular pressure measurements obtained with the three remaining disinfecting regimens of hydrogen peroxide, bleach and alcohol swab. When comparing the image seen while performing the Goldmann measurement, a significant difference was found between the hydrogen peroxide treated biprisms and those treated with bleach or the alcohol swab, with the hydrogen peroxide treated biprisms showing less image distortion. These results suggest that of the three disinfecting reigmens approved by CDC, hydrogen peroxide is the disinfecting agent of choice for the Goldmann biprism.

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The Effect of CDC Recommended Disinfecting Solutions on Goldmann Tonometer Biprisms

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Approved:

Bradley Coffey, O.D., Chairman — Date 6/9/88

Diane P. Yolton, Ph.D., O.D. — Date 6/9/88

A. Richard Reinke, O.D. — Date 6/9/88

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Abstract:

Twelve new Goldmann biprisms were used to measure the intraocular pressure of the right eye of a single subject four times each day for fifteen days. Between measurements, nine of these biprisms were disinfected in the three solutions recommended by the Centers for Disease Control (CDC) as effective against the AIDS virus. The remaining three biprisms were disinfected by rubbing the biprism face with an isopropyl alcohol swab, a standard procedure in many clinical settings.

The intraocular pressure measurements obtained using the four disinfecting regimens were compared to determine if any of the regimens influenced the results. At the time of measurement each biprism was evaluated to determine if any of the regimens affected the clarity of its front surface or the image of the Goldmann rings seen when performing the measurement.

When comparing the clarity of the biprisms, those soaked in alcohol were found to be significantly different from all other groups, with all of the alcohol soaked biprisms being unusable after the fourth day. None of the other three disinfecting groups differed significantly from each other in regard to biprism clarity. Because the biprisms soaked in alcohol were unusable so early in the study, they were not used in the statistical analyses of IOP measurement and biprism image quality. No clinically significant difference was found in intraocular pressure measurements obtained with the three remaining disinfecting regimens of hydrogen peroxide, bleach and alcohol swab. When comparing the image seen while performing the Goldmann measurement, a significant

difference was found between the hydrogen peroxide treated biprisms and those treated with bleach or the alcohol swab, with the hydrogen peroxide treated biprisms showing less image distortion.

These results suggest that of the three disinfecting reigmens approved by CDC, hydrogen peroxide is the disinfecting agent of choice for the Goldmann biprism.

Introduction:

Tonometry, the measurement of the pressure inside the eye, is routinely performed as one of the tests for glaucoma in optometric practices. The Goldmann tonometer is considered the standard instrument for that measurement.[1,2] Because the Goldmann instrument requires corneal contact, it can be a potential source of viral or bacterial transmission from one patient to another.[3,4] To avoid this transmission, some method of disinfection needs to be used on any part of the instrument that comes in direct contact with the eye. However, this disinfection process must not alter the surface characteristics of the instrument in any way that will be harmful to the eye or affect the accuracy of the instrument.

With the discovery of the AIDS virus (HIV) in tears, the Centers for Disease Control (CDC) has issued guidelines for the disinfection of ocular instruments which involve direct eye contact. Three different methods are suggested by the CDC as effective against HIV. These methods require exposing the instruments to solutions of a) a 1:10 dilution of bleach, or b) 3% hydrogen peroxide, or c) 70% ethanol or isopropanol for 5-10 minutes.[5] All contact tonometers, including the Goldmann, are subject to these recommendations.

The part of the Goldmann tonometer that comes in contact with the eye, the biprism, is not one piece, but is formed from multiple pieces of perspex, which is polymethylmethacrylate, glued together. Because of this construction, it is possible that the biprism, when exposed to these disinfecting solutions, may warp, discolor, or be damaged.[6] This could affect the safety of the biprism because an irregular, warped or rough

surface brought into contact with the eye could result in corneal damage. The reliability of the instrument could also be influenced because the Goldmann biprism is designed to yield accurate readings when a diameter of 3.06 mm of corneal tissue is flattened by the front surface of the biprism. Any irregularity, warpage or roughness of that surface could alter the applanated area and potentially affect the intraocular pressure estimates.[7] It is the potential alteration of the biprism's front surface by disinfecting solutions and this alteration's effects on the intraocular pressure measurements or health of the eye that is of concern in this study.

There is little in the literature regarding which solutions can be used on the Goldmann biprism for effective disinfection without causing damage to the biprism. The instruction manual for the Goldmann instrument directs the examiner to "clean the measuring prism with an aqueous solution of Pantasept 0.5% or a similar disinfectant that does not damage perspex (no alcohol solutions)."[8] Pantasept is a concentrated glutaraldehyde solution which is included with the instrument when it is received from the manufacturer. Since it must be diluted to 0.5% for disinfecting the biprism and current literature suggests that a one hour exposure to 2% glutaraldehyde is needed to inactivate the AIDS virus, exposure to this 0.5% concentration is insufficient for disinfection.[9,10] Although the practitioner is warned not to use alcohol in the instruction booklet, one of the most common methods currently used for cleaning the Goldmann biprism is to briefly rub the front surface with an alcohol swab, and rinse it with distilled water.[10,11] This procedure has not been proven sufficient to kill the AIDS virus and is not included in the recommendations from the Centers

for Disease Control. Those practitioners who are comfortable with this cleaning method may be unaware of the manufacturer's warning against alcohol and may choose alcohol soaks as the most convenient method of disinfection from those recommended by the Centers for Disease Control because isopropyl alcohol is quite commonly used on other instruments in optometric offices. Other practitioners, being aware that alcohol is not recommended by the manufacturer, will choose one of the other two disinfecting methods. Because all of the methods recommended by the CDC are effective against the AIDS virus, if one compromises the integrity of the biprism less than the others, it should be advocated as the disinfecting method of choice.

A disinfecting method which is known to be effective against the AIDS virus should be used routinely because of the prevalence of the AIDS virus in the population, and the unproven, yet possible spread of the AIDS virus from contact with the tears. The AIDS virus has been isolated from the tears and conjunctival cells of patients with the syndrome.[12,13] It has also been shown that it can be cultured from high water content contact lenses worn by individuals with AIDS or AIDS related complex. In the study by Tervo and his associates, the AIDS virus was recovered from contact lenses containing 70% water from four out of six patients tested, after 14-16 hours of wear.[14]

There were 29,435 cases of AIDS reported to the CDC in the United States as of January 12, 1987. 89% of these cases were in individuals 20-49 years of age. Of the cases reported in 1981, a 90% fatality rate has been documented.[15] Because infection with the HIV virus is much more common than the reported cases of AIDS, it is estimated that 500,000 to 1 million individuals in the United States are currently

infected with the virus.[16] Many of these individuals have no signs or symptoms of the infection and are not aware that they are infected. Nevertheless, these people are carriers and can transmit the disease to others, probably throughout their lives. In a high prevalence area, the average practitioner could expect one out of every two hundred patients examined to be an HIV infected individual.[16,17] Added to this is the large number of ocular manifestations that will cause a patient with AIDS to seek optometric or ophthalmological help. These include diplopia caused by oculomotor difficulties, decreased vision due to cytomegalovirus retinitis, conjunctivitis, and Kaposi's sarcoma which often affects the eyelids and face.[17,18]

Because of the isolation of the AIDS virus in tears and conjunctival cells of patients with AIDS,[12,13] the prevelance of the undiagnosed infection,[16,17,19] the ability of the virus to remain active for 3-7 days in the dry state,[20] and the fatal nature of the disease,[15,16] it is important that routine methods of disinfection of ocular instruments and contact lenses include methods which are known to inactivate the AIDS virus. Even though no proof of transmission by ocular instruments exists, both the American Optometric Association and the Oregon State Department of Human Resources, Health Division, sent letters to licensed optometrists and ophthalmologists reemphasizing the need for aseptic techniques and urging the use of the CDC guidelines for the disinfection of ocular instruments.[21,22] This study was designed to determine if any of the disinfection methods suggested by the CDC had an effect on the reliability or integrity of the Goldmann biprisms.

Methodology:

Subject:

The right eye of one individual, in good health, with no corneal toricity, drug allergies, history of glaucoma, or other contraindication to the procedure was used for all measurements in this study.

Procedure:

Twelve new Goldmann biprisms were used to compare the routine method of cleaning the biprism against the three different disinfecting regimens recommended as effective against the AIDS virus by the Centers for Disease Control. Three biprisms were disinfected by soaking in three percent hydrogen peroxide, three in a 1:10 aqueous dilution of household bleach, and three in 70% isopropyl alcohol. The remaining three biprisms served as controls and were cleaned by rubbing them with an isopropyl alcohol swab and then rinsing with saline, as is standard practice at Pacific University College of Optometry. Each of the experimental biprisms was soaked in the appropriate solution for two hours, removed from the solution, rinsed with distilled water, dried with cotton as recommended by the manufacturer[8], and visually inspected with the biomicroscope. The visual appearance and clarity of the front surface of the biprism was judged on the following scale: Grade 1: biprism clear at 30X; Grade 2: biprism hazing visible at 30X; Grade 3: biprism hazing visible at 15X; Grade 4: biprism opaque, surface rough or warped; Grade 5: biprism separated. If a grade less than 4 was found upon visual inspection, the

biprism was used in the routine manner to measure the intraocular pressure of the subject. After the measurement had been achieved, each biprism was placed in a fresh preparation of the assigned solution. This sequence was performed four times each day, five days per week for three weeks. In addition, four times each day, alternating with the procedure described above, each biprism was removed from its solution, rinsed, dried and placed into a fresh preparation of the same solution. These conditions were designed to simulate the conditions of the biprism in a general optometric practice, with the practitioner performing tonometry on eight patients a day, five days a week. It was felt that most practitioners would leave the biprism in the disinfecting solution when not actually in use.

When performing the measurement of the intraocular pressure, the following procedure was used. A biomicroscopic examination of the subject's cornea was performed to rule out any contraindications to the use of the Goldmann instrument. Fluress™ was then instilled in both of the subject's eyes and another evaluation of the cornea performed to make certain there was no corneal staining which contraindicated the procedure. Both eyes were anesthetized to decrease the subject's blink reflex even though all measurements were performed on the right eye of the subject. At each of four measurement sessions throughout the day, three measurements of the intraocular pressure were performed with each biprism. The biprisms were used in random order without the investigator knowing which biprism or method of disinfection was being used. This prevented investigator bias from influencing the results. The random order of biprism use also controlled the massage effect by preventing the same biprism from being affected each time. The

massage effect is a temporary decrease in the measurement of the intraocular pressure which occurs when aqueous is forced out of the eye by repeated tonometric readings.[7,23]

As the intraocular pressure measurements were being performed, observations about the image quality were graded on the following scale: Grade 1: Image clear, ring pattern round, no focal irregularities, readings reliable; Grade 2: Image has indistinct borders, ring pattern round, minimal focal irregularities, readings reliable; Grade 3: Image recognizable, ring pattern elliptical, minimal focal irregularites, readings reliable; Grade 4: Image recognizable, ring patttern irregular, focal irregularities, readings suspect; Grade 5: Image unrecognizable, ring pattern too irregular to read. A grade of 5 precluded use of the biprism for further measurements and required an immediate evaluation of the cornea to insure no occurrence of corneal injury that might affect other biprism readings during that data-gathering period. All intraocular pressure measurements were recorded to the nearest one millimeter of mercury. After all measurements were taken, the eye was once again evaluated to confirm that no trauma had occurred.

Apparatus and Materials:

To increase the reliability of the measurements, the same Haag-Streit Goldmann apparatus mounted on the same Mentor biomicroscope was used throughout the experiment. The calibration of the Goldmann tonometer was checked each day by using the control weight as suggested in the instruction manual.[8] The standard procedure for performing Goldmann tonometry as written in Brandreth's book, *Clinical Slit Lamp Biomicroscopy*[24], was used.

All twelve biprisms were manufactured by the same company, and were randomly assigned to a disinfecting regimen.

Data Analysis:

The data derived from day 1, when no disinfecting treatments had been initiated, was used to test for investigator consistency, consistency between biprisms, and subject consistency.

To determine investigator consistency, a correlation coefficient was performed on the three readings taken at each measuring session for each biprism on day 1. The use of each of the twelve biprisms during the three measuring sessions on day 1 resulted in 36 groups of three readings each. High correlations between the first, second and third readings of each biprism at each measuring session would indicate that the investigator was consistent in technique and would allow the average of each probe's readings to be used for analysis. This was desireable because of the findings of Motolko, et al, whose results show improved reproducibility by averaging two or more Goldmann tonometer readings.[23]

Consistency between biprisms was evaluated using a one-way analysis of variance on the average readings achieved with each biprism on day 1. No significant difference between probes would indicate that all biprisms are comparable and reliable at the start of the experiment.

Subject consistency was evaluated using an unpaired t-test of the data derived from day 1, once again when no disinfecting treatments had been started. This was done to determine if the order of biprism use and the potential lowering of the intraocular pressure with repeated measurements, discussed earlier as the massage effect, affected the

results.

The t-test compared the first six intraocular pressure readings to the last six readings of each of the three measurement sessions. A t-test result of no significant difference would indicate that the massage effect was either not large enough to be of concern, or was compensated for adequately by the random order of biprism use in the experimental design.

There are many other factors which may influence the intraocular pressure estimates found with any tonometer. These include but are not limited to diurnal variation, which is known to vary by as much as 2-5 mmHg each day[7,25,26]; caffeine consumption, or other fluid intake[25,26,27]; emotional tension[7,25]; and carotid compression.[7] To attempt to compensate for these variations, the results of each biprism was averaged daily.

This daily average of each biprism's findings was used in a one-factor analysis of variance. The F-test was used to determine if any significant differences between disinfecting regimens existed. If significant differences were found with the analysis of variance, a Scheffe test was used to find where the significance occurred.

Nonparametric statistics were used to evaluate the changes in clarity and image quality of the biprisms. The Mann-Whitney U test, which is the nonparametric version of the two group unpaired t-test, was used for the statistical analyses of these data.

Results:

Statistical analyses performed on the data derived from day 1, when no disinfecting treatments had been started, were designed to show repeatability of the investigator's technique, consistency between biprisms and subject consistency or adequate experimental design to control those variables which are not consistent.

The correlation coefficient derived from the three readings taken with each biprism at each session on day 1 ranged from .839 to .904 (Appendix 4). These high correlations indicated good repeatability of the investigator's technique and therefore the average of each probe's readings was used for analysis.

Analysis of variance on the mean readings derived from day 1 (Appendix 4) indicated no significant differences between the readings taken with the twelve biprisms. This result indicates that all of the biprisms gave consistent and similar readings at the beginning of the experiment.

A t-test was used to evaluate the massage effect by comparing the first 6 readings (E in Appendix 4) achieved at each measuring session, with the last 6 readings (L in Appendix 4) at the same session. There was no significant difference between these two groups. This result indicates that the massage effect was either not large enough to be of concern, or was compensated for adequately by the random order of biprism use in the experimental design.

Based on the results of these analyses, it was decided that the experimental data were reliable and further analyses could be performed.

A one-factor analysis of variance was performed on the intraocular pressure measurements to determine if any of the disinfecting regimens affected the measurements achieved with each biprism. The alcohol soak regimen was not included in this analysis because of the rapid destruction of the biprisms. By the beginning of the fifth day of data collection, these biprisms could no longer be used to measure the intraocular pressure because of rough front surfaces which could potentially cause corneal staining and ocular damage. The rough surfaces appear to have been caused by weakening of the cementing substance used to fabricate the biprisms. The appearance of the Goldmann biprism after three days of the alcohol soak regimen alcohol can be seen in Figure 1 in Appendix 1. Note the early development of a rough anterior surface.

Unlike those soaked in alcohol, the biprisms exposed to each of the remaining disinfecting conditions were all usable throughout the duration of the study. The daily average of the intraocular pressure measurements found with each of the remaining regimens are summarized in the table below and in Figure 1 in Appendix 3.

Daily Average of Intraocular Pressure Measurements

Day	H_2O_2 Soak	Bleach Soak	Alcohol Swab
1	12.22	12.63	12.7
2	12.36	12.39	12.81
3	11.78	12.11	12.22
4	10.50	10.61	10.31
5	12.42	12.5	11.61
6	11.86	11.86	11.19
7	14.17	14.36	13.33
8	12.94	13.94	12.5
9	12.64	13.58	12.92
10	12.36	13.17	13.19
11	13.67	14.33	13.92
12	12.78	12.28	12.81
13	10.94	11.61	10.53
14	13.44	14.28	13.58
15	13.61	14.64	12.36
16	12.72	13.28	12.03

Throughout the 16 days of data collection, the daily averages of intraocular pressure for the different disinfecting groups ranged from a low of 10.31 mmHg to a high of 14.64 mmHg. This is a difference of 4.34 mmHg. Considering the many variables which influence intraocular pressure, these results are reasonable for a normal subject.[7,25,26] When these intraocular pressure measurements were compared, no

significant difference was found between the hydrogen peroxide and the bleach treatments, or between the hydrogen peroxide and alcohol swab treatments. A statistically significant difference ($p<0.05$) was found between the bleach and the alcohol swab treatments, but this difference was not clinically significant. The mean of the alcohol swab treatment was 12.369 mmHg and that of the bleach 12.973 mmHg, resulting in a difference of only 0.6 mmHg. Since the Goldmann tonometer drum is marked in 2 mmHg increments and cannot be read with reliable accuracy to less than 1 mmHg, this is not a clinically distinguishable difference.[28]

To evaluate the changes in clarity of the biprisms throughout the experiment the anterior surface of the biprisms was examined with the biomicroscope. All disinfecting groups were included in the statistical analysis which was performed using the Mann-Whitney U test. A significant difference was found between the alcohol soak and each of the other three groups ($p<0.05$). No significant difference was found between any of the other groups (See Appendix 4). A graphical representation of the changes in clarity found with each disinfecting group over time can be found in Figure 2 of Appendix 3.

Photographs of the appearance of the front surface of the biprisms can be found in Appendix 1. Figure two is the appearance of the front surface of the Goldmann biprism when it is new and unused. It, and the photographs following it represent approximately 4X magnification and can be compared to each other. Figure three shows an alcohol soaked biprism at the end of week one. Note the loss of clarity of the front surface and the rough ring shaped area just inside the edge of the biprism. The results of three weeks of alcohol soak can be seen in

Figures four and five. The roughness of the front surface continued to progress with the addition of crazing of the deeper layers and disruption of the edge material.

The biprisms cleaned with the isopropyl alcohol swabs demonstrated some changes similar, although not as pronounced, to those changes noted in biprisms soaked in alcohol. The ring shaped area just inside the edge of the biprism which first became rough and irregular with the alcohol soaked biprisms, became mottled in appearance in the biprisms cleaned with the alcohol swab. This can be seen in Figures six and seven. The front surface of the biprism is seen in Figure six and represents a rating of three on the clarity scale used throughout the experiment. These changes did not seem to have any effect on the reliability of the readings achieved with these biprisms.

The remaining two disinfecting regimens also resulted in clarity ratings of Grade three before the end of the experiment. The appearance of the front surface of the bleach and hydrogen peroxide soaked biprisms at the end of three weeks can be seen in Figures eight and nine respectively. These two systems of disinfection did not seem to have any effect on the structural integrity of the front surface of the biprisms or the reliability of the measurement achieved with them.

The image quality refers to the appearance of the rings seen when actually applanating the cornea. Because damage to the biprisms soaked in alcohol prevented them from being used after day four, they were not included in the statistics for evaluating image quality. A graphical representation of the change in image quality over time for the different groups can be found in Figure 3 in Appendix 3. As can be seen from the graph, the image quality of the biprisms soaked in hydrogen

peroxide is less distorted than the image quality of the other disinfecting methods. The image of the biprisms in the alcohol swab group had indistinct borders and focal irregularities, while the biprisms soaked in bleach had a blue glare present over all of the image seen through the biomicroscope. This glare decreased the contrast and the clarity of the ring image. The differences found between the image quality of the hydrogen peroxide and the bleach groups and between the hydrogen peroxide and alcohol swab groups were significant ($p<0.05$). No significant difference was found between the alcohol swab group and the bleach group. (See Appendix 4)

Discussion:

These results indicate that the disinfection of Goldmann tonometer biprisms by soaking in isopropyl alcohol should be avoided because this treatment destroys the perspex in less than five days, rendering the biprisms unusable. Wiping the biprism with isopropyl alcohol also produces similar but less severe changes and should be discouraged.
Because of the similar results in intraocular pressure and clarity scale measurements when comparing the hydrogen peroxide and bleach disinfection methods, the quality of the ring pattern image seen with each of the systems becomes the differentiator for the method of first choice. As was previously mentioned, and shown graphically in Figure 3 (Appendix 3), the biprisms soaked in hydrogen peroxide continued to provide a ring pattern image less distorted than the other disinfecting methods throughout the experiment. Because of this result and the equality of the other findings, the use of hydrogen peroxide is the

disinfecting method of first choice.

It should be noted that all of the biprisms seemed to swell slightly after soaking. This did not seem to affect the intraocular pressure measurements achieved, but did make it difficult to insert and remove the biprisms from the holder. For this reason, it would seem prudent to soak each biprism the minimum amount of time necessary to achieve disinfection.

The appearance of the biprisms soaked in hydrogen peroxide and bleach suggested that the haze was due to a deposit of material on the front surface. To test this hypothesis, after the completion of the experiment, one of each of the biprisms was cleaned with a hard contact lens cleaner, rinsed with distilled water and examined. The front surface showed a marked decrease in hazing for both the hydrogen peroxide and bleach soaked biprisms; however, the blue glare, noted on the biprisms soaked in bleach, did not diminish.

Conclusion:

Of the disinfecting regimens recommended by the Centers for Disease Control as effective against the AIDS virus, the method of first choice for use on the Goldmann biprism, as determined by this study, is soaking the biprism in a three percent hydrogen peroxide solution for 5-10 minutes.

Appendix 1- Photographs

Figure 1

Goldmann Biprism after 3 days of Alcohol Soak Regimen

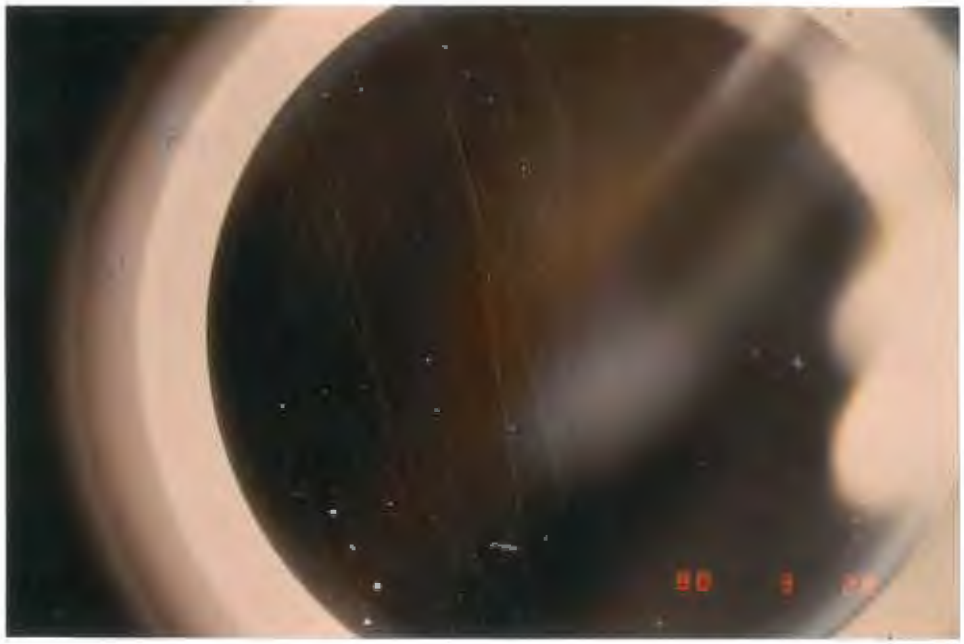


Figure 2

New and Unused Goldmann Biprism

Figure 3

Goldmann Biprism after 1 week of Alcohol Soak Regimen

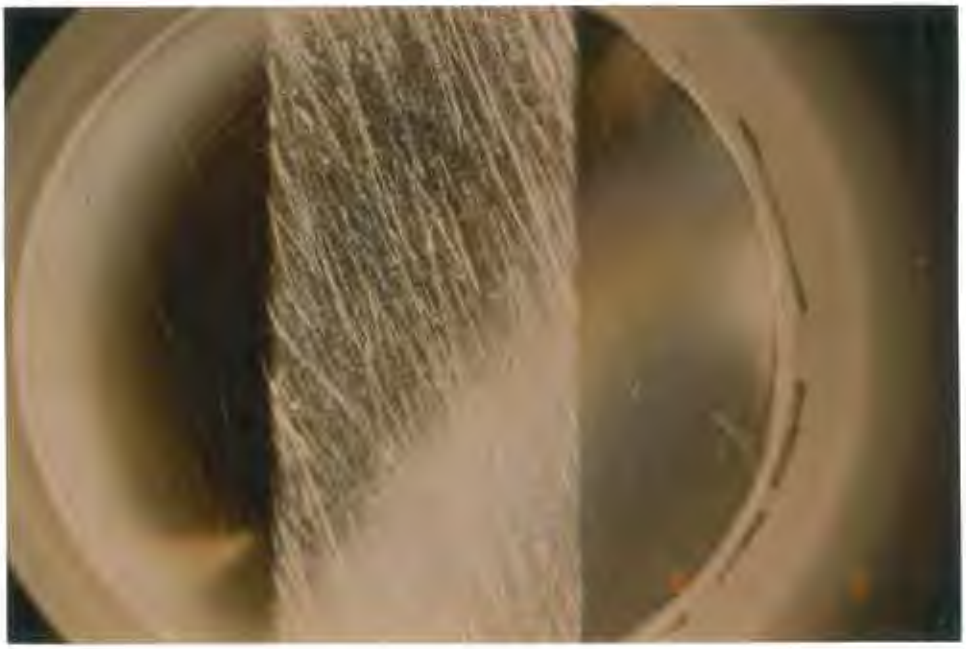


Figure 4

Goldmann Biprism after 3 weeks of Alcohol Soak Regimen

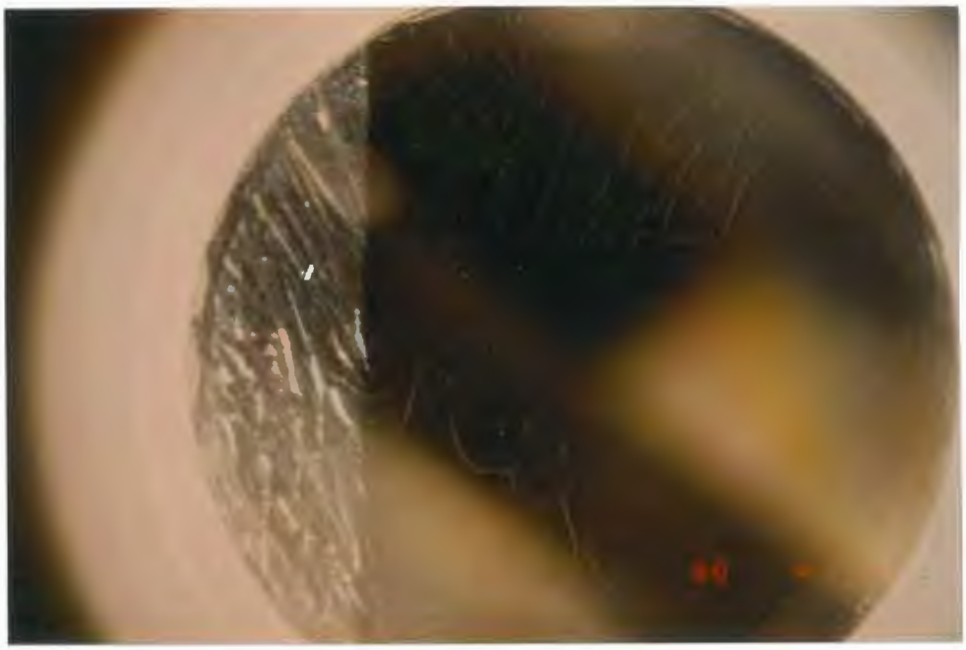


Figure 5

Goldmann Biprism after 3 weeks of Alcohol Soak Regimen

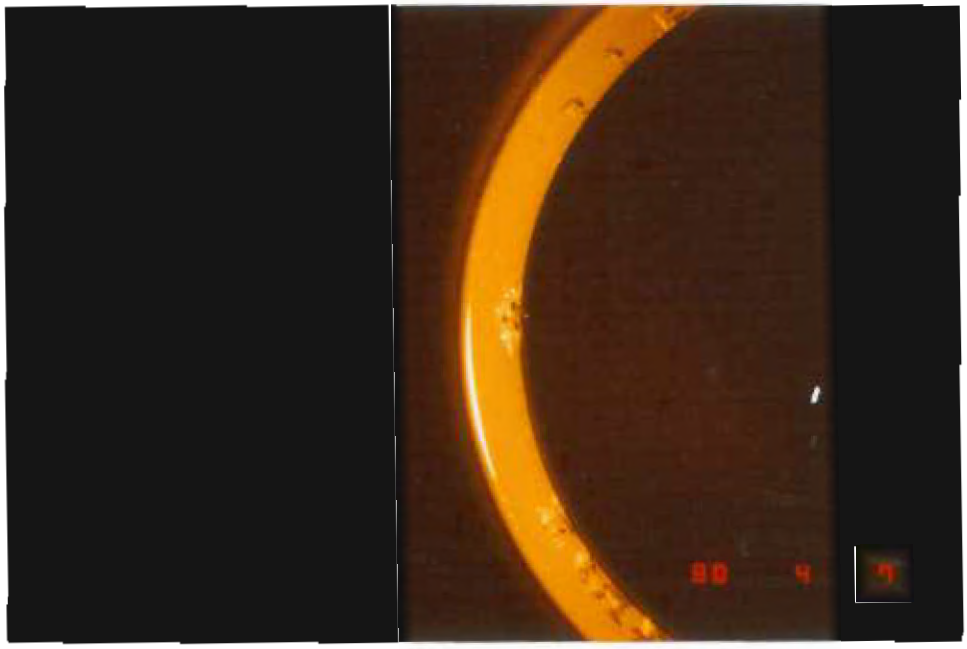


Figure 6

Goldmann Biprism after 3 weeks of Alcohol Swab Regimen

Figure 7

Goldmann Biprism after 3 weeks of Alcohol Swab Regimen

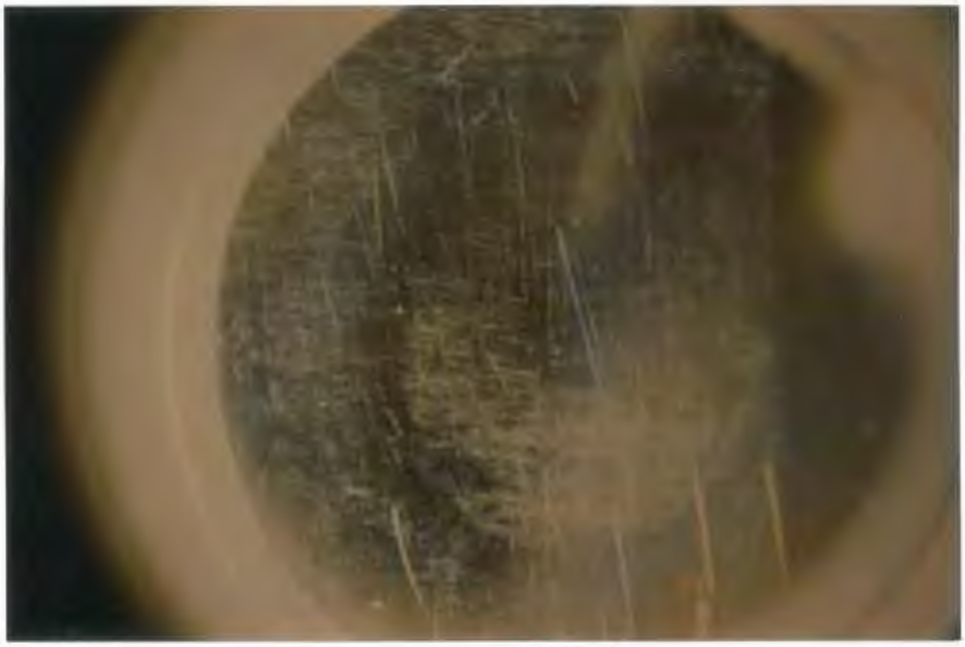


Figure 8

Goldmann Biprism after 3 weeks of Bleach Regimen

Figure 9

Goldmann Biprism after 3 weeks of Hydrogen Peroxide Regimen

Appendix 2- Data Tables

Data Day 1 - No Treatment

							Date May 25, 1987					
Biprism No.	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	# 11	# 12
				Crn. Intg.- Bfr: Clear			Aftr: Clear					
Readings	13	12	14	12	14	13	13	15	12	13	15	12
(mmHg)	13	12	14	12	14	13	12	16	13	14	14	12
	12	12	14	12	14	13	13	15	13	12	15	12
Average	12.67	12	14	12	14	13	12.67	15.33	12.67	13	14.67	12
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1	1	1	1	1	1	1	1	1	1	1
Order of Use	7	9	4	8	2	10	11	1	5	6	3	12
Time 6:00				Crn. Intg.- Bfr: Clear			Aftr: Clear					
Readings	13	14	13	14	12	12	13	13	13	14	13	13
(mmHg)	14	13	14	14	13	13	12	13	13	13	14	14
	14	14	14	13	12	12	13	14	13	14	14	14
Average	13.67	13.67	13.67	13.67	12.33	12.33	12.67	13.33	13	13.67	13.67	13.67
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1	1	1	1	1	1	1	1	1	1	1
Order of Use	9	2	11	4	12	1	8	5	3	10	6	7
Time 9:15				Crn. Intg.- Bfr: Clear			Aftr: Clear					
Readings	11	11	11	11	10	12	11	12	11	11	12	11
(mmHg)	12	11	10	11	10	11	11	12	11	11	12	11
	11	11	11	11	10	12	11	12	11	10	11	12
Average	11.33	11	10.67	11	10	11.67	11	12	11	10.67	11.67	11.33
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1	1	1	1	1	1	1	1	1	1	1
Order of Use	1	7	6	10	8	11	3	4	12	2	9	5
DAILY AVE.	12.56	12.22	12.78	12.22	12.11	12.33	12.11	13.56	12.22	12.44	13.33	12.33
GROUP AVE.		12.52			12.22			12.63			12.7	
Average	12.52											
Stnd. Dev.	0.475											

Data Day 2

							Date June 1, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No,	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 1225				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	13	14	14	12	13	14	14	12	13	14	14	13
(mmHg)	13	13	13	14	13	14	14	12	14	14	13	13
	14	14	13	14	13	14	14	12	14	14	13	14
Average	13.33	13.67	13.33	13.33	13	14	14	12	13.67	14	13.33	13.33
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1	1	1	1	1	1	1	1	1	1	1
Order of Use	1	5	2	7	10	6	9	3	11	12	4	8
Time 2:20				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	13	13	14	14	13	14	14	12	14	13	14	14
(mmHg)	14	12	14	14	13	14	14	12	14	14	14	14
	14	13	13	14	13	14	14	12	13	14	14	14
Average	13.67	12.67	13.67	14	13	14	14	12	13.67	13.67	14	14
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1	1	1	1	1	1	1	1	1	1	1
Order of Use	2	5	11	3	4	7	10	9	7	12	1	6
Time 4:35				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	14	12	14	12	10	12	12	10	12	12	14	12
(mmHg)	14	11	13	12	10	12	12	10	12	12	14	12
	14	11	14	12	10	11	13	10	14	12	13	12
Average	14	11.33	13.67	12	10	11.67	12.33	10	12.67	12	13.67	12
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1	1	1	1	1	1	1	1	1	1	1
Order of Use	4	10	1	12	6	8	5	11	3	2	7	9
Time 6:45				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	11	13	12	11	10	12	12	11	11	11	10	13
(mmHg)	12	13	12	11	10	12	12	11	11	10	11	12
	12	12	12	12	10	12	12	12	11	11	11	12
Average	11.67	12.67	12	11.33	10	12	12	11.33	11	10.67	10.67	12.33
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1	1	1	1	1	1	1	1	1	1	1
Order of Use	5	1	3	9	12	7	6	10	11	4	8	2
DAILY AVE.	13.17	12.58	13.17	12.67	11.5	12.92	13.08	11.33	12.75	12.58	12.92	12.92
GROUP AVE.		12.97			12.36			12.39			12.81	
Comments:												

Data Day 3

							Date June 2, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 11:45				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	12	12	11	13	12	12	14	12	14	12	12	12
(mmHg)	13	13	12	13	12	12	13	12	14	13	12	12
	14	12	12	12	11	12	13	12	14	13	12	12
Average	13	12.33	11.67	12.67	11.67	12	13.33	12	14	12.67	12	12
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	2	1+	1+	1	1	1	1	1*	1	1	1	1
Order of Use	4	10	11	6	2	9	5	3	1	7	12	8
Time 1:35				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	12	13	12	10	13	12	12	11	13	11	13	12
(mmHg)	11	12	11	10	13	12	12	11	13	11	13	13
	10	12	13	10	12	14	12	12	13	12	13	13
Average	11	12.33	12	10	12.67	12.67	12	11.33	13	11.33	13	12.67
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1+	1+	1+	1	1	1	1	1*	1	1	1	1
Order of Use	7	10	2	11	5	8	1	3	12	8	11	4
Time 4:10				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	12	13	12	10	13	12	12	11	13	11	13	12
(mmHg)	11	12	11	10	13	12	12	11	13	11	13	13
	10	12	13	10	12	14	12	12	13	12	13	13
Average	11	12.33	12	10	12.67	12.67	12	11.33	13	11.33	13	12.67
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1+	1+	1+	1	1	1	1	1*	1	1	1	1
Order of Use	8	4	6	1	3	9	12	5	7	10	2	11
Time 6:20				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	13	10	12	12	10	12	11	12	11	12	10	13
(mmHg)	13	10	13	12	12	11	9	11	11	12	10	14
	13	10	12	13	11	10	11	12	12	14	10	13
Average	13	10	12.33	12.33	11	11	10.33	11.67	11.33	12.67	10	13.33
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1	1+	1+	1+	1	1	1*	1*	1*~	1	1	1
Order of Use	4	12	1	5	3	7	8	11	10	2	9	6
DAILY AVE.	12	11.75	12	11.25	12	12.08	11.92	11.58	12.83	12	12	12.67
GROUP AVE.		11.92			11.78			12.11			12.22	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 4

							Date June 3, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Bipriem No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 11:50				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	10	12	12	12	10	12	12	11	12	11	12	12
(mmHg)	11	11	10	12	10	12	12	11	12	11	12	10
	10	10	10	13	10	11	11	12	11	12	12	11
Average	10.33	11	10.67	12.33	10	11.67	11.67	11.33	11.67	11.33	12	11
Image Scale	1	1	1	1	1	1	1	1	1	1	1	1
Clarity Scale	1+	1+	1+	1	1	1~	1~	1~*	1	1	1~	1~
Order of Use	8	2	9	3	10	1	4	7	12	6	11	5
Time 2:00				Crn. Intg.- Bfr: Clr Aftr: SPK (anesthetic)								
Readings	10	12	NR	10	10	10	10	12	9	10	10	10
(mmHg)	11	13	NR	10	10	10	10	12	10	11	10	10
	11	13	NR	11	9	11	10	12	10	11	10	11
Average	10.67	12.67		10.33	9.667	10.33	10	12	9.667	10.67	10	10.33
Image Scale	1dim	1dim		1	1	1	1	1	1	1	1	1
Clarity Scale	1+	1+	4+	1	2	2~	1~	2*	2	2	1~	2~
Order of Use	7	6	2	8	4	10	11	3	1	12	9	5
Time 4:10				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	10	NR	NR	9	10	9	10	9	12	10	10	10
(mmHg)	10	NR	NR	10	10	10	10	8	11	9	9	10
	11	NR	NR	11	10	10	10	9	12	10	10	9
Average	10.33			10	10	9.667	10	8.667	11.67	9.667	9.667	9.667
Image Scale	1			1	1	1	1	1	1	1	1	1
Clarity Scale	1+	4+	4+	1	2~	2~	1~	1~*	1	1	1~	2~
Order of Use	6	5	8	10	2	7	1	11	3	9	4	12
Time 6:10				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	10	NR	NR	8	11	12	9	11	10	10	10	9
(mmHg)	10	NR	NR	9	11	12	9	11	10	9	10	10
	9	NR	NR	10	10	13	10	11	11	10	10	10
Average	9.667			9	10.67	12.33	9.333	11	10.33	9.667	10	9.667
Image Scale	1			1	1	1	1	2	1	1	1	1
Clarity Scale	1+	4+	4+	2	2~	1~	2~	2*~	2	2~	2~	2~
Order of Use	9	5	4	1	6	2	8	11	12	7	3	10
DAILY AVE.	10.25			10.42	10.08	11	10.25	10.75	10.83	10.33	10.42	10.17
GROUP AVE.		10.76			10.5			10.61			10.31	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 5

							Date June 4, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	# 11	# 12
Time 12:50				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	11	9	9	12	11	11	10	12
(mmHg)	NR	NR	NR	11	10	10	10	12	12	10	9	12
	NR	NR	NR	12	9	10	11	11	12	9	10	11
Average				11.33	10	9.667	10	11.67	11.67	10	9.667	11.67
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4 +	4 +	4 +	2	2~	2~	2~	2~*	2	1	2~	1~
Order of Use	10	1	12	9	11	7	8	4	3	5	6	2
Time 3:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	12	11	12	11	9	10	9	10
(mmHg)	NR	NR	NR	12	11	11	11	12	11	11	8	8
	NR	NR	NR	11	11	10	13	9	9	9	9	8
Average				11.67	11.33	10.67	12	10.67	9.667	10	8.667	8.667
Image Scale				1	1	1	2	1	2	2	2	2
Clarity Scale	4 +	4 +	4 +	2	2~	2~	1~	3~*	1~	1	2~	2~
Order of Use	8	9	11	2	3	6	10	4	1	12	7	5
Time 5:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	16	14	15	16	17	16	14	16
(mmHg)	NR	NR	NR	14	15	14	16	16	17	16	14	16
	NR	NR	NR	15	16	14	17	16	17	16	16	16
Average				14.33	15.67	14	16	16	17	16	14.67	16
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4 +	4 +	4 +	2	2~	2~	1~	2~*	2	2	2~	1~
Order of Use	10	3	7	2	5	1	11	6	12	9	4	8
Time7:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	14	14	12	14	10	10	13	10
(mmHg)	NR	NR	NR	14	13	14	12	12	10	10	13	10
	NR	NR	NR	13	13	14	12	13	11	11	14	11
Average				13	13.33	14	12	13	10.33	10.33	13.33	10.33
Image Scale				1	1	1	2	2	2	2	1	2
Clarity Scale	4 +	4 +	4 +	2	1~	2~	1~	2~*	2~	2	2~	2~
Order of Use	9	10	2	8	1	5	6	7	11	4	3	12
DAILY AVE.				12.58	12.58	12.08	12.5	12.83	12.17	11.58	11.58	11.67
GROUP AVE.					12.42			12.5			11.61	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 6

							Date June 5, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	# 11	# 12
Time 1:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	15	13	14	15	16	12	12	14
(mmHg)	NR	NR	NR	14	15	15	15	15	17	12	13	14
	NR	NR	NR	13	15	14	16	15	17	13	13	14
Average				13.67	15	14	15	15	16.67	12.33	12.67	14
Image Scale				2	1	1	2	1	2	2	1	2
Clarity Scale	4	4	4	2~	2	2	2~	2~*	2~	2~	2~	2~
Order of Use	7	2	12	9	3	4	6	11	1	5	8	10
Time 3:00				Cm. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	13	13	11	11	12	12	12	10
(mmHg)	NR	NR	NR	12	13	13	11	11	12	12	12	12
	NR	NR	NR	11	12	13	12	11	13	12	12	12
Average				11.67	12.67	13	11.33	11	12.33	12	12	11.33
Image Scale				1	1	1	2	1	2	2	1	2
Clarity Scale	4 +	4 +	4 +	2~	2~	2~	2~	2~*	2~	2~	2~	2~
Order of Use	7	10	9	8	2	1	6	5	4	12	11	3
Time 5:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	9	11	8	7	10	10	10	7	9
(mmHg)	NR	NR	NR	10	11	8	7	10	10	10	6	10
	NR	NR	NR	10	10	9	7	11	10	9	7	10
Average				9.667	10.67	8.333	7	10.33	10	9.667	6.667	9.667
Image Scale				1	1	1	2	1	2	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	2~	3~	2~	2~*	2~	2~	2~*	2~*
Order of Use	11	3	9	10	5	12	2	8	1	6	7	4
Time 7:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	10	12	11	12	10	12	12	10
(mmHg)	NR	NR	NR	12	10	12	11	13	10	12	12	10
	NR	NR	NR	12	10	12	11	13	10	12	12	10
Average				11.67	10	12	11	12.67	10	12	12	10
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	2~	2~	2~	2~*	3~	2~*	2~*	2~*
Order of Use	3	7	2	8	4	11	6	9	12	10	5	1
DAILY AVE.				11.67	12.08	11.83	11.08	12.25	12.25	11.5	10.83	11.25
GROUP AVE.					11.86			11.86			11.19	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 7

							Date June 8, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 9:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	12	14	13	14	15	13	12	14
(mmHg)	NR	NR	NR	12	12	14	13	14	15	12	11	14
	NR	NR	NR	13	12	15	14	13	15	12	10	14
Average				13	12	14.33	13.33	13.67	15.67	12.33	11	14
Image Scale				1	1	2	2	2	2	1	2	1
Clarity Scale	4+	4+	4+	3~	3~	2~	3~	3~*	3~	3~	3~*	2~*
Order of Use	9	11	10	12	7	1	2	3	4	6	8	5
Time 11:10				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	16	15	15	15	15	16	15	15	14
(mmHg)	NR	NR	NR	16	15	15	16	15	16	15	15	14
	NR	NR	NR	16	16	16	15	15	16	15	16	14
Average				16	15.33	15.33	15.33	15	16	15	15.33	14
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~	3~*	3~*
Order of Use	1	12	7	9	3	2	6	5	1*	4	10	8
Time 1:10				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	17	15	15	14	16	15	14	14	14
(mmHg)	NR	NR	NR	17	14	15	14	17	15	15	13	14
	NR	NR	NR	16	14	15	15	16	15	15	15	14
Average				16.67	14.33	15	14.33	16.33	15.33	14.67	14	14
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	11	9	4	5	1	12	10	3	6	8	2	7
Time 3:20				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	10	15	12	12	14	1*	12	10	13
(mmHg)	NR	NR	NR	11	15	12	12	14	1*	12	11	13
	NR	NR	NR	10	16	13	12	15	1*	12	12	12
Average				10.33	15.33	12.33	12	14.33	1*	12	11	12.67
Image Scale				1	1	1	2	2	2	1	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~	3~*	3~*
Order of Use	3	10	9	7	5	6	1	4	12	2	11	8
DAILY AVE.				14	14.25	14.25	13.75	14.83	14.5	13.5	12.83	13.67
GROUP AVE.					14.17			14.36			13.33	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 8

							Date June 9, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	#10	#11	#12
Time 9:15				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	14	15	15	14	14	14	11	12
(mmHg)	NR	NR	NR	14	14	15	16	14	15	14	12	13
	NR	NR	NR	14	14	14	16	15	15	15	13	12
Average				14	14	14.67	15.67	14.33	14.67	14.33	12	12.33
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~	3~*	3~*
Order of Use	5	6	8	7	1	11	4	9	12	2	3	10
Time 11:20				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	12	12	12	12	12	13	12	10
(mmHg)	NR	NR	NR	13	12	13	13	11	12	13	12	11
	NR	NR	NR	12	12	12	14	13	13	14	12	12
Average				12.33	12	12.33	13	12	12.33	13.33	12	11
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~	3~*	3~*
Order of Use	5	8	6	10	11	4	2	3	1	12	7	9
Time 1:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	13	14	14	15	14	16	12	14	14
(mmHg)	NR	NR	NR	13	15	14	15	15	16	13	14	14
	NR	NR	NR	12	16	14	15	15	16	13	14	14
Average				12.67	15	14	15	14.67	16	12.67	14	14
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~	3~*	3~*
Order of Use	9	6	7	12	3	2	11	5	1	10	8	4
Time 3:15				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	10	10	14	15	12	13	11	10	12
(mmHg)	NR	NR	NR	10	11	13	15	12	13	11	11	13
	NR	NR	NR	11	10	14	14	11	14	11	11	13
Average				10.33	10.33	13.67	14.67	11.67	13.33	11	10.67	12.67
Image Scale				1	1	1	2	2	2	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~	3~*	3~*
Order of Use	9	8	12	3	7	11	4	6	1	5	10	2
DAILY AVE.				12.33	12.83	13.87	14.58	13.17	14.08	12.83	12.17	12.5
GROUP AVE.					12.94			13.94			12.5	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 9

							Date June 10, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	# 11	# 12
Time 8:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	11	13	12	16	12	14	13	14
(mmHg)	NR	NR	NR	12	12	13	12	16	14	14	14	13
	NR	NR	NR	13	12	12	13	15	14	14	13	15
Average				12.33	11.67	12.67	12.33	15.67	13.33	14	13.33	14
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~ *	3 ~ °	3 ~ °	3 ~ *
Order of Use	11	1	9	2	4	8	6	5	10	12	3	7
Time 11:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	16	14	14	13	13	15	14	14	15
(mmHg)	NR	NR	NR	16	14	14	13	14	16	15	14	15
	NR	NR	NR	16	15	14	13	14	16	15	14	15
Average				16	14.33	14	13	13.67	15.67	14.67	14	15
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~ *	3 ~ *	3 ~ °	3 ~ *
Order of Use	5	3	11	2	9	12	7	8	10	4	6	1
Time 2:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	13	11	14	13	14	12	12	13
(mmHg)	NR	NR	NR	12	13	12	14	14	15	12	13	13
	NR	NR	NR	13	12	12	14	14	15	13	11	13
Average				12	12.67	11.67	14	13.67	14.67	12.33	12	13
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~ °	3 ~ *	3 ~ °	3 ~ °
Order of Use	9	5	6	7	1	8	3	2	10	4	12	11
Time 4:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	12	12	12	14	11	11	10	11
(mmHg)	NR	NR	NR	11	12	11	12	14	11	12	11	10
	NR	NR	NR	12	11	11	12	14	11	11	11	11
Average				11.33	11.67	11.33	12	14	11	11.33	10.67	10.67
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~ *	3 ~ *	3 ~ *	3 ~ °
Order of Use	5	3	1	2	9	10	4	8	6	7	12	11
DAILY AVE.				12.92	12.58	12.42	12.83	14.25	13.67	13.08	12.5	13.1
GROUP AVE.					12.64			13.58			12.92	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 10

							Date June 11, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 9:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	13	13	14	12	14	14	12	13	15
(mmHg)	NR	NR	NR	13	13	14	13	14	14	12	14	15
	NR	NR	NR	13	13	14	13	14	14	11	14	15
Average				13	13	14	12.67	14	14	11.67	13.67	15
Image Scale				1	1	1	3	2	2	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~°	3~°	3~°
Order of Use	12	2	4	5	9	6	8	10	11	1	3	7
Time 11:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	15	14	15	15	15	16	13	14	16
(mmHg)	NR	NR	NR	15	14	15	16	15	16	14	14	16
	NR	NR	NR	16	14	15	16	16	15	14	14	16
Average				15.33	14	15	15.67	15.33	15.67	13.67	14	16
Image Scale				1	1	1	3	2	2	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~°	3~°	3~°
Order of Use	12	6	11	3	10	1	5	2	4	8	9	7
Time 1:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	10	8	11	10	11	14	12	14	12
(mmHg)	NR	NR	NR	11	10	11	10	10	14	13	14	12
	NR	NR	NR	10	11	12	11	12	14	14	13	12
Average				10.33	9.667	11.33	10.33	11	14	13	13.67	12
Image Scale				1	1	1	3	3	2	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~°	3~°	3~°
Order of Use	2	8	6	9	5	12	7	1	3	11	4	10
Time 3:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	10	10	12	12	11	11	10	12	13
(mmHg)	NR	NR	NR	11	11	10	12	11	12	10	12	14
	NR	NR	NR	12	10	12	13	12	12	10	13	13
Average				11	10.33	11.33	12.33	11.33	11.67	10	12.33	13.33
Image Scale				1	1	1	3	3	2	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~°	3~°	3~°
Order of Use	2	1	7	11	4	3	9	10	5	12	8	6
DAILY AVE.				12.42	11.75	12.92	12.75	12.92	13.83	12.08	13.42	14.03
GROUP AVE.					12.36			13.17			13.19	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 11

							Date June 12, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 12:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	14	15	15	14	15	15	15	14
(mmHg)	NR	NR	NR	15	13	15	15	14	15	15	15	14
	NR	NR	NR	15	14	15	15	14	15	15	15	14
Average				14.67	13.67	15	15	14	15	15	15	14
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~°	3~	3~°	3~°	3~°
Order of Use	7	12	8	1	11	4	9	2	6	10	5	3
Time 2:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	13	13	12	14	15	14	14	14	12
(mmHg)	NR	NR	NR	13	14	13	14	16	15	14	14	13
	NR	NR	NR	12	14	13	14	16	14	14	13	13
Average				12.67	13.67	12.67	14	15.67	14.33	14	13.67	12.67
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~°	3~	3~°	3~°	3~°
Order of Use	4	8	11	6	9	10	5	12	3	1	2	7
Time 4:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	13	14	14	14	15	12	14	14
(mmHg)	NR	NR	NR	14	13	14	14	14	15	12	14	14
	NR	NR	NR	15	13	15	14	15	15	13	14	14
Average				14.33	13	14.33	14	14.33	15	12.33	14	14
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~°	3~	3~°	3~°	3~°
Order of Use	12	8	7	11	3	5	1	2	6	4	9	10
Time 6:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	13	14	14	13	13	14	14	14	14
(mmHg)	NR	NR	NR	13	12	14	14	13	14	14	14	14
	NR	NR	NR	13	13	14	14	13	14	14	15	14
Average				13	13	14	13.67	13	14	14	14.33	14
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~°	3~	3~°	3~°	3~°
Order of Use	3	11	2	7	10	9	1	12	8	4	6	5
DAILY AVE.				13.67	13.33	14	14.17	14.25	14.58	13.83	14.25	13.67
GROUP AVE.					13.67			14.33			13.92	
Comments:	° Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 12

							Date June 15, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	#10	#11	#12
Time 1:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	12	14	10	13	12	12	11	11
(mmHg)	NR	NR	NR	11	12	14	10	13	13	12	12	11
	NR	NR	NR	11	12	13	10	13	14	11	12	11
Average				11	12	13.67	10	13	13	11.67	11.67	11
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~	3 ~ *	3 ~ *	3 ~ *
Order of Use	6	2	8	10	12	4	1	9	7	5	3	11
Time 3:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	10	10	10	12	12	11	13	15
(mmHg)	NR	NR	NR	12	10	11	10	13	12	12	13	15
	NR	NR	NR	11	10	12	11	14	12	12	12	15
Average				11.67	10	11	10.33	13	12	11.67	12.67	15
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~	3 ~ *	3 ~ *	3 ~ *
Order of Use	2	4	5	7	1	11	10	12	3	8	9	6
Time 5:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	15	14	14	12	13	14	14	15	12
(mmHg)	NR	NR	NR	15	14	14	12	13	14	15	16	13
	NR	NR	NR	16	15	15	13	14	13	16	16	13
Average				15.33	14.33	14.33	12.33	13.33	13.67	15	15.67	12.67
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~	3 ~ *	3 ~ *	3 ~ *
Order of Use	10	6	3	4	2	5	12	9	1	7	11	8
Time 7:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	15	13	11	11	14	11	12	14
(mmHg)	NR	NR	NR	11	15	13	12	11	14	11	11	14
	NR	NR	NR	12	15	14	12	12	13	12	11	14
Average				11.67	15	13.33	11.67	11.33	13.67	11.33	11.33	14
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3 ~	3 ~	3 ~	3 ~	3 ~ *	3 ~	3 ~ *	3 ~ *	3 ~ *
Order of Use	7	3	1	5	2	4	11	6	9	10	12	8
DAILY AVE.				12.42	12.83	13.08	11.08	12.67	13.08	12.42	12.83	13.17
GROUP AVE.					12.78			12.28			12.81	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 13

							Date June 16, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 3:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	10	11	12	12	12	8	13	9
(mmHg)	NR	NR	NR	12	10	11	13	13	12	9	13	10
	NR	NR	NR	12	12	12	13	14	13	10	14	10
Average				12	10.67	11.33	12.67	13	12.33	9	13.33	9.667
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	6	2	10	3	9	12	4	1	11	8	7	5
Time 5:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	12	8	12	12	12	10	11	12
(mmHg)	NR	NR	NR	14	12	9	13	12	12	11	11	12
	NR	NR	NR	13	12	10	14	12	12	10	11	12
Average				13.67	12	9	13	12	12	10.33	11	12
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	9	10	8	4	2	7	3	11	12	6	1	5
Time 7:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	10	10	11	10	12	9	11	10
(mmHg)	NR	NR	NR	11	11	10	11	10	12	9	11	9
	NR	NR	NR	11	11	10	11	11	12	10	11	9
Average				11	10.67	10	11	10.33	12	9.333	11	9.333
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	8	1	12	7	4	10	9	3	11	2	5	6
Time 9:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	9	12	9	12	10	10	11	10
(mmHg)	NR	NR	NR	10	9	12	10	12	10	10	12	10
	NR	NR	NR	11	8	11	9	11	10	10	11	10
Average				10.67	8.667	11.67	9.333	11.67	10	10	11.33	10
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	12	7	6	1	4	8	11	5	10	9	3	2
DAILY AVE.				11.83	10.5	10.5	11.5	11.75	11.58	9.667	11.67	10.25
GROUP AVE.					10.94			11.61			10.53	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 14

							Date June 17, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	#10	#11	#12
Time 12:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	14	15	17	16	17	15	15	15
(mmHg)	NR	NR	NR	14	14	16	17	16	17	15	16	15
	NR	NR	NR	14	14	17	18	15	17	14	16	16
Average				14	14	16	17.33	15.67	17	14.67	15.67	15.33
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	2	6	10	11	9	4	7	1	8	12	3	5
Time 2:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	13	13	12	13	14	12	14	14
(mmHg)	NR	NR	NR	12	12	14	12	13	14	12	13	14
	NR	NR	NR	12	12	14	12	12	14	13	14	14
Average				12	12.33	13.67	12	12.67	14	12.33	13.67	14
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	5	8	4	2	12	1	9	7	10	11	6	
Time 4:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	16	10	12	13	12	16	12	12	13
(mmHg)	NR	NR	NR	15	11	12	13	12	16	13	13	13
	NR	NR	NR	16	12	12	13	13	15	12	14	12
Average				15.67	11	12	13	12.33	15.67	12.33	13	12.67
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	11	4	10	9	5	12	7	6	8	3	1	2
Time 6:15				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	14	12	13	15	14	14	13	12
(mmHg)	NR	NR	NR	15	14	12	13	14	14	14	13	12
	NR	NR	NR	14	14	13	13	15	14	14	13	13
Average				14.33	14	12.33	13	14.67	14	14	13	12.33
Image Scale				1	1	1	3	2	3	2	2	2
Clarity Scale	4 +	4 +	4 +	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	9	1	10	2	3	8	12	7	4	5	6	11
DAILY AVE.				14	12.83	13.5	13.83	13.83	15.17	13.33	13.83	13.53
GROUP AVE.					13.44			14.28			13.58	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 15

							Date June 18, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 12:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	13	14	14	14	16	14	12	14	13
(mmHg)	NR	NR	NR	13	14	14	15	16	15	12	14	14
	NR	NR	NR	13	14	14	15	16	15	13	15	15
Average				13	14	14	14.67	16	14.67	12.33	14.33	14
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4+	4+	4+	3-	3-	3-	3-	3-*	3-	3-*	3-*	3-*
Order of Use	3	2	12	4	10	9	5	7	1	8	11	6
Time 2:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	14	14	16	14	15	14	14	12
(mmHg)	NR	NR	NR	14	14	13	16	14	15	14	14	12
	NR	NR	NR	15	14	13	16	14	15	14	15	13
Average				14.33	14	13.33	16	14	15	14	14.33	12.33
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4+	4+	4+	3-	3-	3-	3-	3-*	3-	3-*	3-*	3-*
Order of Use	12	2	6	8	3	4	1	10	11	9	5	7
Time 4:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	14	13	12	12	13	11	10	10
(mmHg)	NR	NR	NR	14	13	13	13	13	13	12	10	11
	NR	NR	NR	13	13	13	13	14	14	13	10	10
Average				13.67	13.33	13	12.67	13	13.33	12	10	10.33
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4+	4+	4+	3-	3-	3-	3-	3-*	3-	3-*	3-*	3-*
Order of Use	12	5	3	2	11	7	1	4	6	8	10	9
Time				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	16	11	14	15	15	15	10	12	12
(mmHg)	NR	NR	NR	15	12	14	16	15	16	11	12	12
	NR	NR	NR	15	12	13	16	14	17	12	11	12
Average				15.33	11.67	13.67	15.67	14.67	16	11	11.67	12
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4+	4+	4+	3-	3-	3-	3-	3-*	3-	3-*	3-*	3-*
Order of Use	7	4	5	2	10	8	3	6	1	9	11	12
DAILY AVE.				14.08	13.25	13.5	14.75	14.42	14.75	12.33	12.58	12.17
GROUP AVE.					13.61			14.64			12.36	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Data Day 16

							Date June 19, 1987					
	ALCOHOL SOAK			H2O2 SOAK			BLEACH SOAK			ALCOHOL SWAB		
Biprism No.	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Time 11:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	12	13	11	12	12	11	10	11
(mmHg)	NR	NR	NR	14	12	14	13	12	13	12	10	11
	NR	NR	NR	14	13	14	13	13	13	12	10	12
Average				14	12.33	13.67	12.33	12.33	12.67	11.67	10	11.33
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	5	8	1	2	7	12	11	3	10	9	6	4
Time 2:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	14	12	14	13	14	15	10	14	11
(mmHg)	NR	NR	NR	13	12	14	13	14	15	10	14	12
	NR	NR	NR	13	13	13	14	14	14	10	13	12
Average				13.33	12.33	13.67	13.33	14	14.67	10	13.67	11.67
Image Scale				1	1	1	3	3	3	2	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	6	11	8	9	4	2	1	7	3	12	10	5
Time 4:30				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	11	12	13	12	11	13	12	13	14
(mmHg)	NR	NR	NR	11	12	13	13	12	14	12	12	13
	NR	NR	NR	11	13	14	14	12	14	12	12	13
Average				11	12.33	13.33	13	11.67	13.67	12	12.33	13.33
Image Scale				1	1	1	3	3	3	1	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	4	11	1	2	5	7	8	3	9	10	12	6
Time 6:00				Crn. Intg.- Bfr: Clr Aftr: Clr								
Readings	NR	NR	NR	12	12	12	14	14	14	14	13	12
(mmHg)	NR	NR	NR	13	12	12	14	13	14	14	12	12
	NR	NR	NR	13	12	12	14	14	14	14	12	12
Average				12.67	12	12	14	13.67	14	14	12.33	12
Image Scale				1	1	1	3	3	3	1	2	2
Clarity Scale	4+	4+	4+	3~	3~	3~	3~	3~*	3~	3~*	3~*	3~*
Order of Use	10	2	12	11	7	5	4	9	3	8	1	6
DAILY AVE.				12.75	12.25	13.17	13.17	12.92	13.75	11.92	12.08	12.08
GROUP AVE.					12.72			13.28			12.03	
Comments:	* Two ? areas			~ crystallization of glue @180								
	+ Opaque glue 360°											

Appendix 3- Figures

FIGURE 1
Average Daily Readings

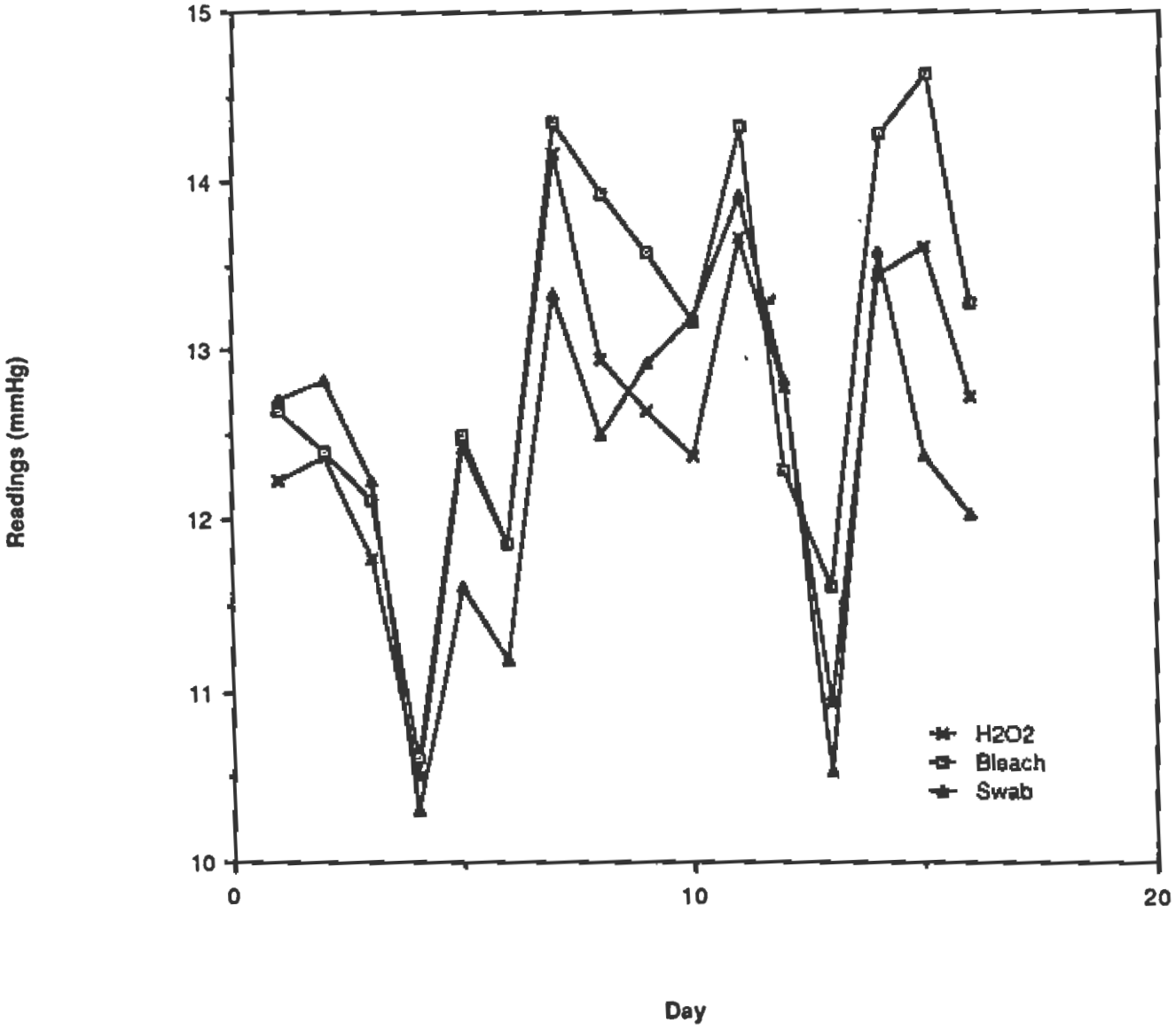


FIGURE 2

Graph of Clarity Scale Plotted as a Function of Time

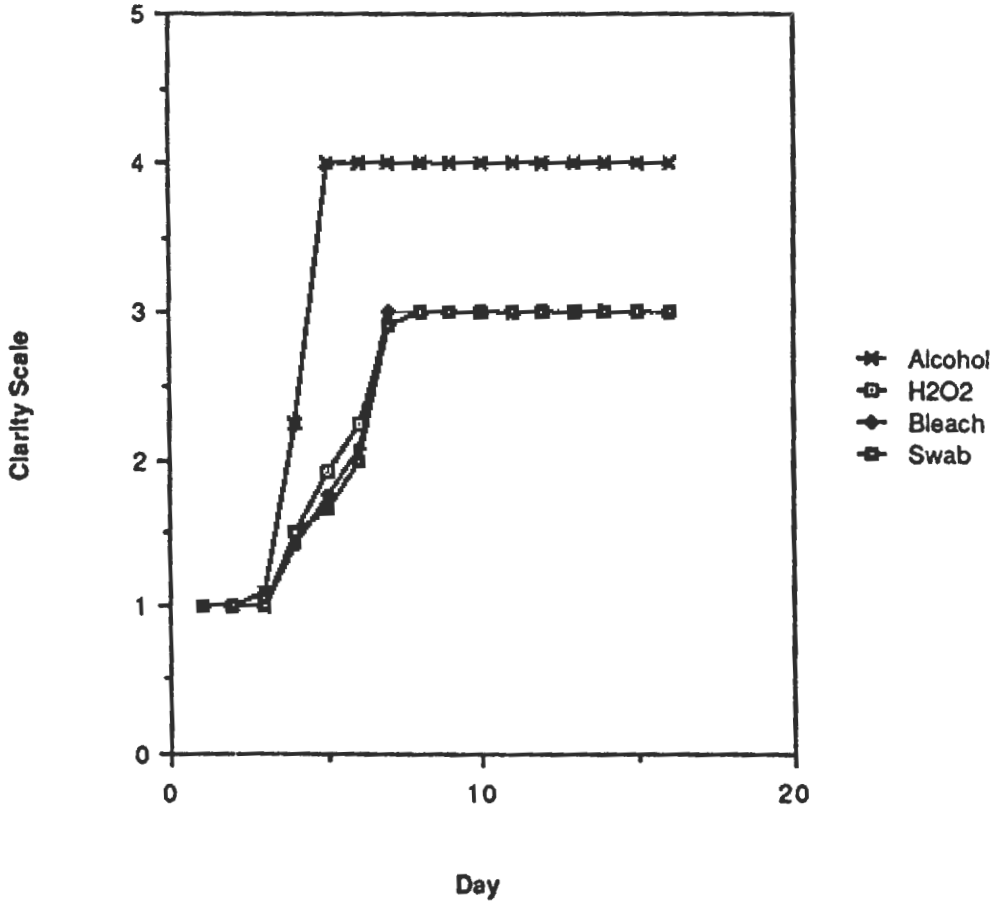
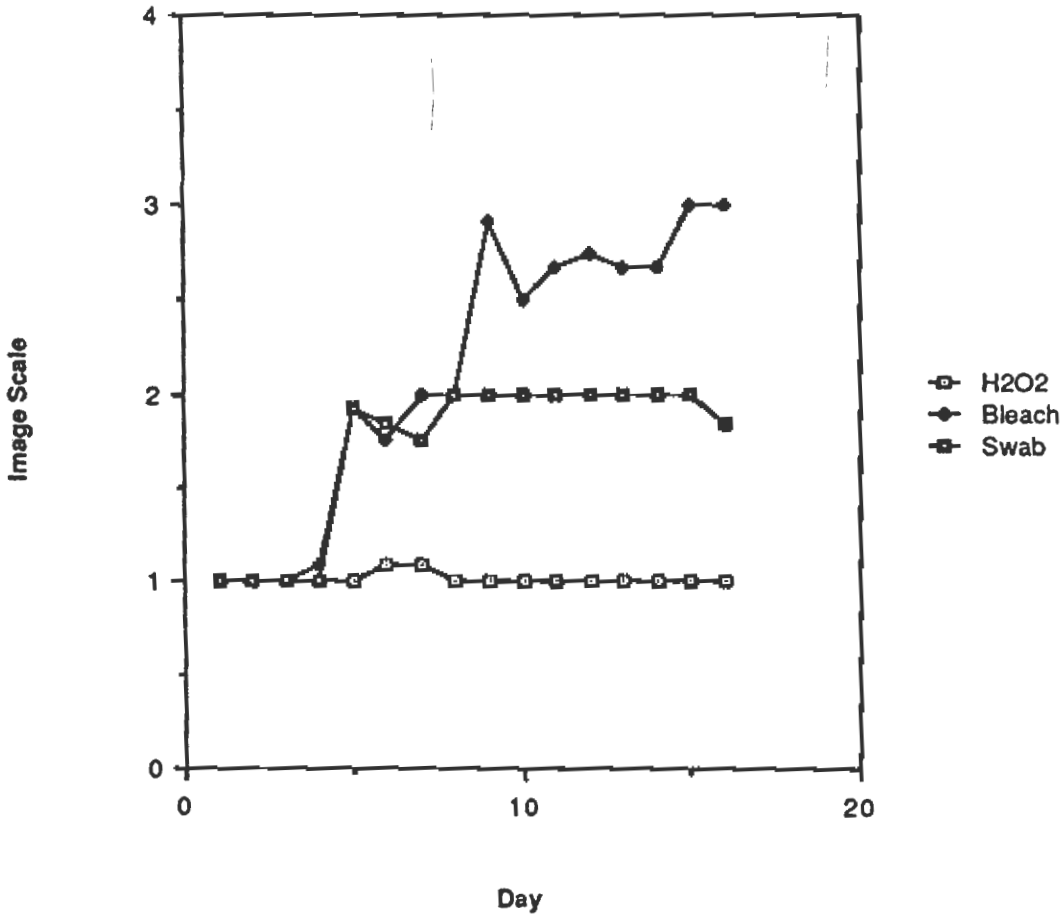


FIGURE 3

Graph of Image Scale Plotted as a Function of Time



Appendix 4- Statistical Analysis

Correlation of Single Probe Multiple Readings

Correlation Matrix for Variables: X_1 ... X_3

	Reading 1	Reading 2	Reading 3
Reading 1	1		
Reading 2	.862	1	
Reading 3	.904	.839	1

	Reading 1	Reading 2	Reading 3
1	13	13	12
2	12	12	12
3	14	14	14
4	12	12	12
5	14	14	14
6	13	13	13
7	13	12	13
8	15	16	15
9	12	13	13
10	13	14	12
11	15	14	15
12	12	12	12
13	13	14	14
14	14	13	14
15	13	14	14
16	14	14	13
17	12	13	12
18	12	13	12
19	13	12	13
20	13	13	14
21	13	13	13
22	14	13	14
23	13	14	14
24	13	14	14
25	11	12	11
26	11	11	11
27	11	10	11
28	11	11	11
29	10	10	10
30	12	11	12
31	11	11	11
32	12	12	12
33	11	11	11
34	11	11	10
35	12	12	11
36	11	11	12

DATA DAY 1

- - - - - - - - - - O N E W A Y - - - - - - - - - -

Variable V3 RESULTS
By Variable V1 BIPRISM NO

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	11	22.2963	2.0269	1.2111	.2902
Within Groups	96	160.6667	1.6736		
Total	107	182.9630			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean
Grp 1	9	12.5556	1.1304	.3768	11.6867 To 13.4244
Grp 2	9	12.2222	1.2019	.4006	11.2984 To 13.1460
Grp 3	9	12.7778	1.6415	.5472	11.5160 To 14.0395
Grp 4	9	12.2222	1.2019	.4006	11.2984 To 13.1460
Grp 5	9	12.1111	1.7638	.5879	10.7553 To 13.4669
Grp 6	9	12.3333	.7071	.2357	11.7898 To 12.8769
Grp 7	9	12.1111	.9280	.3093	11.3978 To 12.8244
Grp 8	9	13.5556	1.5092	.5031	12.3955 To 14.7157
Grp 9	9	12.2222	.9718	.3239	11.4752 To 12.9692
Grp10	9	12.4444	1.5092	.5031	11.2843 To 13.6045
Grp11	9	13.3333	1.4142	.4714	12.2463 To 14.4204
Grp12	9	12.3333	1.1180	.3727	11.4739 To 13.1927
Total	108	12.5185	1.3076	.1258	12.2691 To 12.7680

***** Given WORKSPACE allows for 5550 Cells with 2 Dimensions for MEANS.

Summaries of V3 RESULTS
By levels of V1 BIPRISM NO
V2 TIME

Variable	Value	Label	Mean	Std Dev	Cases
For Entire Population			12.5185	1.3076	108
V1	1.00		12.5556	1.1304	9
V2	1.00		12.6667	.5774	3
V2	3.00		13.6667	.5774	3
V2	5.00		11.3333	.5774	3
V1	2.00		12.2222	1.2019	9
V2	1.00		12.0000	0.0	3
V2	3.00		13.6667	.5774	3
V2	5.00		11.0000	0.0	3
V1	3.00		12.7778	1.6415	9
V2	1.00		14.0000	0.0	3
V2	3.00		13.6667	.5774	3
V2	5.00		10.6667	.5774	3
V1	4.00		12.2222	1.2019	9
V2	1.00		12.0000	0.0	3
V2	3.00		13.6667	.5774	3
V2	5.00		11.0000	0.0	3
V1	5.00		12.1111	1.7638	9
V2	1.00		14.0000	0.0	3
V2	3.00		12.3333	.5774	3
V2	5.00		10.0000	0.0	3
V1	6.00		12.3333	.7071	9
V2	1.00		13.0000	0.0	3
V2	3.00		12.3333	.5774	3
V2	5.00		11.6667	.5774	3
V1	7.00		12.1111	.9280	9
V2	1.00		12.6667	.5774	3
V2	3.00		12.6667	.5774	3
V2	5.00		11.0000	0.0	3
V1	8.00		13.5556	1.5092	9
V2	1.00		15.3333	.5774	3
V2	3.00		13.3333	.5774	3
V2	5.00		12.0000	0.0	3
V1	9.00		12.2222	.9718	9
V2	1.00		12.6667	.5774	3
V2	3.00		13.0000	0.0	3
V2	5.00		11.0000	0.0	3
V1	10.00		12.4444	1.5092	9
V2	1.00				

V1	11.00	13.3333	1.4142	9
V2	1.00	14.6667	.5774	3
V2	3.00	13.6667	.5774	3
V2	5.00	11.6667	.5774	3
V1	12.00	12.3333	1.1180	9
V2	1.00	12.0000	0.0	3
V2	3.00	13.6667	.5774	3
V2	5.00	11.3333	.5774	3

Total Cases = 108

Group	Minimum	Maximum
Grp 1	11.0000	14.0000
Grp 2	11.0000	14.0000
Grp 3	10.0000	14.0000
Grp 4	11.0000	14.0000
Grp 5	10.0000	14.0000
Grp 6	11.0000	13.0000
Grp 7	11.0000	13.0000
Grp 8	12.0000	16.0000
Grp 9	11.0000	13.0000
Grp10	10.0000	14.0000
Grp11	11.0000	15.0000
Grp12	11.0000	14.0000
Total	10.0000	16.0000

Tests for Homogeneity of Variances

Cochrans C = Max. Variance/Sum(Variances) = .1549, P = .642 (Approx.)
Bartlett-Box F = .981 , P = .461
Maximum Variance / Minimum Variance 6.222

T-Test of time 0 Order Data

Unpaired t-Test X_1: Order Y_1: Readings

DF:	Unpaired t Value:	Prob. (2-tail):
34	1.322	.195

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
E	18	12.889	1.711	.403
L	18	12.278	.958	.226

	Readings	Order
1	15	E
2	16	E
3	15	E
4	12	E
5	13	E
6	12	E
7	11	E
8	12	E
9	11	E
10	14	E
11	14	E
12	14	E
13	14	E
14	13	E
15	14	E
16	11	E
17	11	E
18	10	E
19	13	L
20	12	L
21	13	L
22	13	L
23	14	L
24	14	L
25	13	L
26	11	L
27	12	L
28	12	L
29	12	L
30	12	L
31	12	L
32	13	L
33	12	L
34	11	L
35	11	L
36	11	L

1 factor ANOVA of probe daily averages

One Factor ANOVA X_1: Groups Y_1: Readings

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	9.432	4.716	3.753
Within groups	141	177.195	1.257	p = .0258
Total	143	186.626		

Model II estimate of between component variance = 1.73

One Factor ANOVA X_1: Groups Y_1: Readings

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
H2O2	48	12.526	1.025	.148
Bleach	48	12.973	1.25	.18
Swab	48	12.369	1.076	.155

One Factor ANOVA X_1: Groups Y_1: Readings

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
H2O2 vs. Bleach	-.447	.452	1.91	1.955
H2O2 vs. Swab	.157	.452	.235	.685
Bleach vs. Swab	.604	.452*	3.484*	2.64

* Significant at 95%

	Readings	Groups
	Y_1	X_1
1	12.22	H202
2	12.67	H202
3	11.25	H202
4	10.42	H202
5	12.58	H202
6	11.67	H202
7	14.00	H202
8	12.33	H202
9	12.92	H202
10	12.42	H202
11	13.67	H202
12	12.42	H202
13	11.83	H202
14	14.00	H202
15	14.08	H202
16	12.75	H202
17	12.11	H202
18	11.50	H202
19	12.00	H202
20	10.08	H202
21	12.58	H202
22	12.08	H202
23	14.25	H202
24	12.83	H202
25	12.58	H202
26	11.75	H202
27	13.33	H202
28	12.83	H202
29	10.50	H202
30	12.83	H202
31	13.25	H202
32	12.25	H202
33	12.33	H202
34	12.92	H202
35	12.08	H202
36	11.00	H202
37	12.08	H202
38	11.83	H202
39	14.25	H202
40	13.67	H202

	Readings	Groups
	Y_1	X_1
41	12.42	H202
42	12.92	H202
43	14.00	H202
44	13.08	H202
45	10.50	H202
46	13.50	H202
47	13.50	H202
48	13.17	H202
49	12.11	Bleach
50	13.08	Bleach
51	11.92	Bleach
52	10.25	Bleach
53	12.50	Bleach
54	11.08	Bleach
55	13.75	Bleach
56	14.58	Bleach
57	12.83	Bleach
58	12.75	Bleach
59	14.17	Bleach
60	11.08	Bleach
61	11.50	Bleach
62	13.83	Bleach
63	14.75	Bleach
64	13.17	Bleach
65	13.56	Bleach
66	11.33	Bleach
67	11.58	Bleach
68	10.75	Bleach
69	12.83	Bleach
70	12.25	Bleach
71	14.83	Bleach
72	13.17	Bleach
73	14.25	Bleach
74	12.92	Bleach
75	14.25	Bleach
76	12.67	Bleach
77	11.75	Bleach
78	13.83	Bleach
79	14.42	Bleach
80	12.92	Bleach

	Readings	Groups
	Y_1	X_1
81	12.22	Bleach
82	12.75	Bleach
83	12.83	Bleach
84	10.83	Bleach
85	12.17	Bleach
86	12.25	Bleach
87	14.50	Bleach
88	14.08	Bleach
89	13.67	Bleach
90	13.83	Bleach
91	14.58	Bleach
92	13.08	Bleach
93	11.58	Bleach
94	15.17	Bleach
95	14.75	Bleach
96	13.75	Bleach
97	12.44	Swab
98	12.58	Swab
99	12.00	Swab
100	10.33	Swab
101	11.58	Swab
102	11.50	Swab
103	13.50	Swab
104	12.83	Swab
105	13.08	Swab
106	12.08	Swab
107	13.83	Swab
108	12.42	Swab
109	9.67	Swab
110	13.33	Swab
111	12.33	Swab
112	11.92	Swab
113	13.33	Swab
114	12.92	Swab
115	12.00	Swab
116	10.42	Swab
117	11.58	Swab
118	10.83	Swab
119	12.83	Swab
120	12.17	Swab

	Readings	Groups
	Y_1	X_1
121	12.50	Swab
122	13.42	Swab
123	14.25	Swab
124	12.83	Swab
125	11.67	Swab
126	13.83	Swab
127	12.58	Swab
128	12.08	Swab
129	12.33	Swab
130	12.92	Swab
131	12.67	Swab
132	10.17	Swab
133	11.67	Swab
134	11.25	Swab
135	13.67	Swab
136	12.50	Swab
137	13.17	Swab
138	14.08	Swab
139	13.67	Swab
140	13.17	Swab
141	10.25	Swab
142	13.28	Swab
143	12.17	Swab
144	12.08	Swab

Mann-Whitney U test of Clarity Scale

Mann-Whitney U X_1: Groups Y_1: Readings

	Number:	Σ Rank:	Mean Rank:
Alcohol	16	340	21.25
Bleach	16	188	11.75

U	52
U-prime	204
Z	-2.864
Z corrected for ties	-2.997
# tied groups	3

Mann-Whitney U test of Clarity Scale

Mann-Whitney U X_1: Groups Y_1: Readings

	Number:	Σ Rank:	Mean Rank:
Alcohol	16	340	21.25
Swab	16	188	11.75

U	52
U-prime	204
Z	-2.864
Z corrected for ties	-2.983
# tied groups	3

Mann-Whitney U test of Clarity Scale

Mann-Whitney U X_1: Groups Y_1: Readings

	Number:	Σ Rank:	Mean Rank:
H2O2	16	260.5	16.281
Bleach	16	267.5	16.719

U	124.5
U-prime	131.5
Z	-.132
Z corrected for ties	-.149
# tied groups	2

Mann-Whitney U test of Clarity Scale

Mann-Whitney U X_1: Groups Y_1: Readings

	Number:	Σ Rank:	Mean Rank:
Bleach	16	269.5	16.844
Swab	16	258.5	16.156

U	122.5
U-prime	133.5
Z	-.207
Z corrected for ties	-.234
# tied groups	2

Mann-Whitney U test of Clarity Scale

Mann-Whitney U X_1: Groups Y_1: Readings

	Number:	Σ Rank:	Mean Rank:
H2O2	16	265	16.562
Swab	16	263	16.438

U	127
U-prime	129
Z	-.038
Z corrected for ties	-.042
# tied groups	4

Mann-Whitney U test of Clarity Scale

Mann-Whitney U X_1: Groups Y_1: Readings

	Number:	Σ Rank:	Mean Rank:
Alcohol	16	339.5	21.219
H2O2	16	188.5	11.781

U	52.5
U-prime	203.5
Z	-2.846
Z corrected for ties	-2.964
# tied groups	4

	Readings	Groups
1	1.00	Alcohol
2	1.00	Alcohol
3	1.08	Alcohol
4	2.25	Alcohol
5	4.00	Alcohol
6	4.00	Alcohol
7	4.00	Alcohol
8	4.00	Alcohol
9	4.00	Alcohol
10	4.00	Alcohol
11	4.00	Alcohol
12	4.00	Alcohol
13	4.00	Alcohol
14	4.00	Alcohol
15	4.00	Alcohol
16	4.00	Alcohol
17	1.00	H202
18	1.00	H202
19	1.00	H202
20	1.50	H202
21	1.92	H202
22	2.25	H202
23	2.92	H202
24	3.00	H202
25	3.00	H202
26	3.00	H202
27	3.00	H202
28	3.00	H202
29	3.00	H202
30	3.00	H202
31	3.00	H202
32	3.00	H202
33	1.00	Bleach
34	1.00	Bleach
35	1.00	Bleach
36	1.42	Bleach
37	1.75	Bleach
38	2.08	Bleach
39	3.00	Bleach
40	3.00	Bleach

	Readings	Groups
41	3.00	Bleach
42	3.00	Bleach
43	3.00	Bleach
44	3.00	Bleach
45	3.00	Bleach
46	3.00	Bleach
47	3.00	Bleach
48	3.00	Bleach
49	1.00	Swab
50	1.00	Swab
51	1.00	Swab
52	1.50	Swab
53	1.67	Swab
54	2.00	Swab
55	2.92	Swab
56	3.00	Swab
57	3.00	Swab
58	3.00	Swab
59	3.00	Swab
60	3.00	Swab
61	3.00	Swab
62	3.00	Swab
63	3.00	Swab
64	3.00	Swab

Mann-Whitney U test of Image Scale

Mann-Whitney U X_1: Group Y_1: Reading

	Number:	Σ Rank:	Mean Rank:
H2O2	16	164	10.25
Bleach	16	364	22.75

U	28
U-prime	228
Z	-3.769
Z corrected for ties	-4.091
# tied groups	5

Mann-Whitney U test of Image Scale

Mann-Whitney U X_1: Group Y_1: Reading

	Number:	Σ Rank:	Mean Rank:
Bleach	16	310	19.375
Swab	16	218	13.625

U	82
U-prime	174
Z	-1.734
Z corrected for ties	-1.771
# tied groups	7

Mann-Whitney U test of Image Scale

Mann-Whitney U X_1: Group Y_1: Reading

	Number:	Σ Rank:	Mean Rank:
H2O2	16	172	10.75
Swab	16	356	22.25

U	36
U-prime	220
Z	-3.467
Z corrected for ties	-3.861
# tied groups	4

	Reading	Group
1	1.00	H202
2	1.00	H202
3	1.00	H202
4	1.00	H202
5	1.00	H202
6	1.08	H202
7	1.08	H202
8	1.00	H202
9	1.00	H202
10	1.00	H202
11	1.00	H202
12	1.00	H202
13	1.00	H202
14	1.00	H202
15	1.00	H202
16	1.00	H202
17	1.00	Bleach
18	1.00	Bleach
19	1.00	Bleach
20	1.08	Bleach
21	1.92	Bleach
22	1.75	Bleach
23	2.00	Bleach
24	2.00	Bleach
25	2.92	Bleach
26	2.50	Bleach
27	2.67	Bleach
28	2.75	Bleach
29	2.67	Bleach
30	2.67	Bleach
31	3.00	Bleach
32	3.00	Bleach
33	1.00	Swab
34	1.00	Swab
35	1.00	Swab
36	1.00	Swab
37	1.92	Swab
38	1.83	Swab
39	1.75	Swab
40	2.00	Swab

	Reading	Group
41	2.00	Swab
42	2.00	Swab
43	2.00	Swab
44	2.00	Swab
45	2.00	Swab
46	2.00	Swab
47	2.00	Swab
48	1.83	Swab

Appendix 5- Informed Consent Form

Informed Consent Form

1) Institution

A. Title of project: "The Effect of Disinfection Solutions on Goldmann Tonometer Biprisms"

B. Principal Investigator: Nada J. Lingel, O.D. Phone: 359-5641

C. Advisor: Bradley Coffey, O.D. Phone: 357-6151 ext. 2280

D. Location: Pacific University College of Optometry
Forest Grove, Oregon 97116

E. Date: 22 May 87.

2) Description of Project

This project is designed to determine what effect(s), if any, three different CDC recommended methods for disinfection against the AIDS virus have on the structural integrity of the Goldmann tonometer biprism. This will be determined by: a) visually inspecting the biprisms under magnification, and b) comparing the readings obtained from the biprisms disinfected by these means with those cleaned in the routine manner.

In the procedure, I will inspect each biprism to be used on your eye with a biomicroscope to make sure it is smooth and safe. A topical anesthetic and dye will be instilled into your eye for your comfort during the procedure, and I will then measure the pressure inside of your eye with the Goldmann tonometer, a standard optometric instrument and routine. Several readings will be taken with each biprism to assure accuracy of measurement.

At the conclusion of these measurements, a thorough evaluation of the health of your eye will be provided, and you will be free to leave.

3) Description of Risks

Participants in this study may experience corneal abrasion, and/or allergic reaction to the diagnostic agent utilized (Fluress). Both of these infrequent but possible complications clear up without treatment within 24 hours.

4) Description of Benefits

This study will serve to determine the safest method of disinfecting ophthalmic equipment against the AIDS virus. This increased knowledge will serve to better protect the public against the possible spread of the virus from routine optometric procedures.

5) Compensation and Medical Care

If you are injured in this experiment it is possible that you will not receive compensation of medical care from Pacific University, the experimenter, or any organization associated with the experiment. All responsible care will be used to prevent injury, however.

6) Alternatives Advantageous to Subjects

Not applicable.

7) Offer to Answer Any Inquiries

The experimenter 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 Dr. James Peterson at 357-0442. During your participation in the project you are not a clinic patient for the purposes of the research, and all questioins should be directed to the researcher and/or the faculty advisor who will be soley responsible for any treatment (except for an emergency).

8) Freedom to Withdraw

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

9) Confidentiality of Records

All information collected will be treated as confidential. Publication of results will involve only grouped data or individual data in which you are identified only by initials or random code number.

Consent Form

I have read and understand the above. I am 18 years of age or over.

PRINTED NAME_____AGE_____

SIGNED_____DATE_____

ADDRESS_____PHONE_____

CITY_____STATE/ZIP_____

NAME AND ADDRESS OF A PERSON NOT LIVING WITH YOU WHO WILL ALWAYS KNOW YOUR ADDRESS:

_____

_____

_____

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