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### A comparison of conjunctival bacteria in contact lens wearers and noncontact lens wearers

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## **A comparison of conjunctival bacteria in contact lens wearers and noncontact lens wearers**

### **Abstract**

The lower conjunctival fornix of 241 contact lens wearers and nonwearers were sampled then cultured to determine the presence or lack of bacteria. Several other factors were also investigated: the duration of contact lens wear, the hours/day of wear, the type or types of solutions used, lens hygiene, the age, and the sex of the subjects. A Chi Squared Test was used as the criteria of difference. The incidence of bacteria for contact lens wearers did not differ from nonwearers. Incidence was not influenced by any of the other factors either.

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John R. Gerke

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A Fourth Year Optometry Project  
Presented to the  
College of Optometry  
Pacific University

A Comparison of Conjunctival  
Bacteria in Contact Lens  
Wearers and Noncontact  
Lens Wearers

In partial fulfillment  
for the requirements for the degree  
Doctor of Optometry

by

Lawrence H. Ellett

Thomas D. Stevens

Advisor: Dr. John R. Gerke, Ph.D.



May 1975

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## ABSTRACT

The lower conjunctival fornix of 241 contact lens wearers and nonwearers were sampled then cultured to determine the presence or lack of bacteria. Several other factors were also investigated: the duration of contact lens wear, the hours/day of wear, the type or types of solutions used, lens hygiene, the age, and the sex of the subjects.

A Chi Squared Test was used as the criteria of difference. The incidence of bacteria for contact lens wearers did not differ from nonwearers. Incidence was not influenced by any of the other factors either.

## INTRODUCTION

Contact lens care aids and vision care specialists' instructions to contact lens users are aimed to minimize the risk of adding microorganisms to the user's cornea and conjunctiva. Finding no published study demonstrating whether this aim is achieved with the general population of contact lens users, we initiated a study. Carson and Winkler<sup>1</sup> describe the normal, nonpathogens and pathogens of the conjunctiva. Soudakoff<sup>2</sup>, in a study involving 3000 patients, found that the incidence of conjunctival culture showing no growth varied from 21 to 54.6%, depending on the technique used. However, few studies have dealt with the incidence of conjunctival bacteria associated with contact lens wearers. Kapetansky<sup>3</sup>, et al, found (from cultures of the conjunctiva, carrying case, and wetting or soaking solutions) that 65% of the samples exhibited no bacteria

or nonpathogenic bacteria and that 35% showed the existence of potential pathogens with Pseudomonas aeruginosa the most common. This study was done before the incorporation of effective anti-microbials in contact lens solutions. At that time there was a relatively high incidence of severe ocular infection among contact lens wearers. According to Allen<sup>4</sup> the current apparent decrease in ocular infection of contact lens wearers is due to 3 main factors: 1) contact lens storage cases have been designed to eliminate foreign materials; 2) soaking solutions are more effective in their bacterial action; and 3) both patients and the vision care specialists have become increasingly aware of the possible bacteriological dangers and have realized the importance of good contact lens hygiene.

Recently (Barnard, P., M. L. Rainer, and A. Smith, an unpublished thesis, College of Optometry, Pacific University) in a study involving 42 contact lens wearers and 60 nonwearers, found a lower incidence of bacterial growth among the contact lens wearing group. But, they found the difference to be statistically insignificant. They concluded that their population was too small to draw a positive conclusion. The research technique used in our study was similar to that used by the above researchers.

The primary objective of our investigation was to compare the incidence of conjunctival bacteria of contact lens wearers and the nonwearers. Other factors such as age, sex, occupation, general health, duration of contact lens wear, and lens hygiene were also compared with the incidence of conjunctival bacteria. Sampled were

120 contact lens wearers and 127 nonwearers including both males and females of diverse ages and occupations. We found no significant difference in the incidence of conjunctival bacteria between contact lens wearers and nonwearers, or between any of the other factors investigated.

#### MATERIALS AND METHODS

Samples were taken in the Forest Grove, Portland, and Albina clinics of Pacific University, College of Optometry, and 5 private practitioner's offices. Each of the subjects was asked to complete a questionnaire (Figure 1). Part I was given to all subjects; Part II to conventional lens wearers; and Part III to flexible lens wearers. Samples from the lower tarsal and fornical conjunctiva of each eye were taken with a saline moistened cotton applicator. Fahmy's<sup>5</sup>, et al, data on the topographical distribution of bacteria of normal conjunctivas indicates that 93% of the organisms on the normal conjunctiva will be found if sampling is done in this location. Care was taken not to touch the lid margin. Each applicator was placed in a sterile tube and refrigerated until plated within 4 days. The samples were plated on Typticase Soy Agar (BBL). Trypticase Soy Agar grows a diversity of microbial species including most of the opportunistic corneal pathogens such as Staphylococcus aureus and P. aeruginosa. Some types of gram negative rods and diplococci (Neisseria), Haemophilus, and some types of streptococci are not culturable on the media.<sup>6</sup> These exclusions, however, would apply to both contact lens wearers and nonwearers and would



not bias the comparison. The plates were incubated for 48 hours at 38°C. Presence or absence of microbial growth was determined with the aid of an American Optical Co. Colony Counter. The microorganisms were not identified.

The Chi Squared Test at the 0.90 level of confidence was used to determine statistical significance of results.<sup>7</sup>

### RESULTS

The incidence of growth in the cultures of eyes sampled is shown in Table I. Overall, the incidence was 11% and the relative incidence for contact lens wearers was slightly less than for nonwearers. The  $X^2$  for the data equalled 0.6631, which is less than the critical value of 7.879, therefore, the difference was not significant. Of the 53 eyes exhibiting culture growth, 31 occurred from the sample of one eye and not the other.

Based on the questionnaire responses the data was tabulated, per subject (not per eye as for Table I) as shown in Table II. The incidence of culture growth was relatively large in the nonstudent vs student, over 30 vs under 30, and those who did not clean their carrying cases daily vs those who did; however, there were no significant differences in the  $X^2$  calculation for any of the factors.

Because there were almost twice as many students as nonstudents in the study, we compared the incidence of growth vs no growth without regard to contact wear (Table III) to see if the large

proportion of students prejudiced the data. Again, the calculated  $\chi^2$  was below the critical value and there was no significant difference between groups.

#### DISCUSSION

Morrison's<sup>8</sup> data on the population of contact lens wearers in the United States indicates our population is representative of contact lens wearers in both age and sex. While the relationship between the incidence of bacteria and the type of vision care facility was not studied, we felt that the inclusion of multiple locations broadened the basis of this study. None of the other variables; time of wear, hours/day of wear, personal hygiene, lens hygiene, general health, age, sex, or occupation showed a significant difference. However, there were some interesting and reasonable trends. First, students (vs nonstudents) had a lower incidence of growth (Table II). In both the contact lens and the noncontact lens wearers the incidence of growth for students (10.5% and 17.0% respectively) was one-half to two-thirds of the nonstudents (20.0% and 26.9% respectively). Secondly, although it did not show up in the contact lens wearing group, the nonwearers under 30 years of age had one-third (9.8%) the incidence of growth of the older group (27.8%). Newer wearers, i.e. those wearing their contacts less than 10 hours/day, had twice (27.6%) the incidence of the older, full time wearers (11.6%). Concerning the general lens hygiene, those who did not change the solution in their carrying case daily

had twice the incidence (26.9%) of those who did (13.3%). Also, those who used a 3-in-1 solution had twice the incidence (23.1%) of those who used a cleaning, soaking, and wetting solutions (11.6%). These trends might become statistically significant if a much larger population were tested. The lower overall incidence of conjunctival bacteria found in this study (11%) compared to Soudakoff's<sup>2</sup> (79 to 45%) could be due to the different culture conditions used.

The lack of difference in incidence of cultures from contact lens wearers and nonwearers indicates that the contact aids and the vision care specialists' instructions to contact lens wearers are effective in minimizing the risk of adding microorganisms to the users conjunctiva.

TABLE I

Incidence of Bacteria for Contact Lens Wearers and Noncontact Lens Wearers (per eye tested)

	Growth	No Growth	Total
Contact Lens Wearer	23 (5%)	218 (44%)	241 (49%)
Noncontact Lens Wearer	30 (6%)	224 (45%)	254 (51%)
Total	53 (11%)	442 (89%)	495 (100%)

TABLE II

Incidence of Bacteria for Contact Lens Wearers and Noncontact Lens Wearers and Associated Factors (per subject tested)

G - Growth NG - No Growth

<u>All Subjects</u>	Contact Lens Wearers			Nonwearers			Grand Total
	G	NG	Total	G	NG	TOTAL	
Sex							
Male	3	28	31	13	50	63	94
Female	15	69	84	11	52	63	147
Occupation							
Student	7	60	67	17	83	100	167
Nonstudent	11	44	55	7	19	26	81
Age							
30 or less	13	83	96	11	92	103	199
Over 30	2	11	13	3	8	11	24
Associated Conditions							
Noneye (cold, allergies, etc.)	3	23	26	8	28	36	62
Eye (conjunctivitis, watery eyes, etc.)	1	2	3	2	6	8	11
None	15	75	90	14	71	85	175
Use of Eye Drops (Murine, Visine, Etc.)							
Yes	4	21	25	3	11	14	39
No	14	77	91	21	91	112	203

TABLE II (Continued)

	Contact Lens Wearers			Nonwearers			Grand Total
	G	NG	Total	G	NG	Total	
<u>Contact Lens Wearers Only</u>							
Total Time Wearing Lenses							
5 years or less	15	77	92				
Over 5 years	3	19	22				
Hours/Day							
Less than 10	8	21	29				
10 or More	10	76	86				
Wash Hands Before Insertion							
Never or Seldom	2	11	13				
Often or Always	16	87	103				
How Often Lenses Cleaned							
Daily	13	74	87				
Less than Daily	5	23	28				
Solutions Used*							
Cleaning Only	5	12	17				
Soaking Only	0	1	1				
Wetting Only	0	3	3				
Cleaning and Wetting	0	6	6				
Soaking and Wetting	1	5	6				
All Three	8	61	69				
3-in-1 Solution	3	10	13				
How Often was the Solution in the Case Changed							
Daily	5	13	15				
Less Than Daily	25	68	93				
Stored Dry	0	4	4				

\*For the calculations the responses were grouped into "3-in-1", "All Three", and "The Remainder".

TABLE III

Incidence of Bacteria for Students and Nonstudents (per subject tested)

	Growth	No Growth	Total
Student	24	143	167
Nonstudent	18	63	81

QUESTIONNAIRE (Figure I)

PART I

Sample No. \_\_\_\_\_

Name \_\_\_\_\_

Sex M F

Occupation \_\_\_\_\_

Age \_\_\_\_\_

Do you have a cold, the flu, an ear infection, allergies, an eye infection, watery eyes, or lids that stick?

Do you use eye drops? Y N What? \_\_\_\_\_

Do you wear contact lenses? Y N

Have you ever worn contact lenses? Y N

PART II

Type of contact lenses: conventional flexible

How long have you worn contacts? years \_\_\_\_\_ months \_\_\_\_\_

How many hours/day do you wear your lenses? \_\_\_\_\_

Do you wash your hands before inserting your lenses?

never seldom often always

PART IIIA Conventional Lenses

Do you clean your lenses daily? Y N

If not, how often? \_\_\_\_\_

Do you use a Cleaning Sol'n Soaking Sol'n

Wetting Sol'n 3 in 1 Sol'n

Do you change the soaking sol'n in your case daily? Y N

If not, how often \_\_\_\_\_

How do you store your lenses? wet dry

PART IIIB Flexible Lenses

Do you clean your lenses daily? Y N

If not, how often \_\_\_\_\_

Do you aseptize your lenses daily? Y N

If not, how often \_\_\_\_\_

What type of cleaner do you use? Saline Pligel Soft/Mate Other



REFERENCES

1. Cason, T. and C. H. Winkler, Bacteriology of the Eye, AMA Archives Ophth, 51: 196-199, 1954.
2. Soudakoff, P.S., Bacteriologic Examination of the Conjunctiva, A Survey on 3000 Patients, Amer. J. Ophth, 38: 374-376, 1954.
3. Kapetansky, F. M., T. Suie, A.D. Gracy, and J. L. Bitonte, Bacteriologic Studies of Patients Who Wear Contact Lenses, Amer. J. Ophth., 57: 255-258, 1964.
4. Allen, A., Who's Afraid of the Little Green Bug?, Contact Lens Medical Bulletin, 5(1): 2-14, Jan./Mar., 1972.
5. Fahmy, J. A., S. Moller, and M. Weis Bentzon, Bacterial Flora of the Normal Conjunctiva, I. Topographical Distribution, ACTA Ophthalmologica, 52: 787, 1974.
6. DIFCO Manual of Dehydrated Culture Media and Reagents for Microbiological and Clinical Laboratory Procedures DIFCO Laboratories Incorporated, 9th ed., 100, 1953.
7. Mendenhall, W., Introduction to Probability and Statistics, Duxbury Press, 3rd ed., 1971.
8. Morrison, R. J., A Survey of 100 Consecutive Contact Lens Patients, J. Am. Optom. Assoc., 43(2): 179-183, 1972.