

EFFICACY OF MULTI-PURPOSE “NO RUB”
CONTACT LENS SOLUTION DISINFECTANTS

by

Heather Elizabeth Buist, B.S.
Ramanpal Kaur Deol, B.S.

This paper is submitted in partial fulfillment of the
requirements for the degree of

Doctor of Optometry

Ferris State University
Michigan College of Optometry

May, 2005

ABSTRACT

Background: There are many soft contact lens solutions on the market today, each product claiming to be the most effective at disinfecting. This research study compares the efficacy of the following multi-purpose “no rub” soft contact lens solutions and their respective disinfectants: Solo Care Plus, Opti-Free Express, Renu Multiplus and Clear Care. *Methods:* The solutions were tested against *Pseudomonas aeruginosa*, *Staphylococcus epidermis*, and *Candida albicans*. Each organism was grown on several agar plates with paper discs in the center that were saturated with the previously mentioned multi-purpose solutions. The zones of inhibition created by the paper discs were measured, thus allowing a comparison between the solutions under study. *Results:* The Clear Care solution showed the greatest disinfectant capability compared to the rest. All solutions showed some disinfectant properties towards *Pseudomonas aeruginosa*. However, Opti-Free, Renu, and Solo Care Plus did not show any disinfectant capabilities towards *Staphylococcus epidermis* and *Candida albicans*.

ACKNOWLEDGMENTS

This project would not have been possible without the invaluable expertise of Mr. Frank Hartley. We are grateful for his guidance on this project.

INTRODUCTION:

There are many cleaning products on the market that advertise they disinfect—each one saying their product is better at disinfecting than the competition. One might ask, which product really is the best? The same situation may be applied to the contact lens solution industry. They all say “disinfects” on the label, but which is best? The Food and Drug Administration (FDA) requires that today’s contact lens solutions must disinfect against six organisms, including the following three; *Pseudomonas aeruginosa*, *Staphylococcus epidermis*, and *Candida albicans*.¹ The solutions to be used against these will be four no-rub brands. “No-rub” is of particular interest since they are fast becoming popular as time savers. However, that means there is more demand on the solution to disinfect since there is no rubbing action to help remove the organisms. Which no-rub soft contact lens solution will be the most effective at inhibiting the growth of these three organisms?

One of the main reasons contact lens wearers use solutions to disinfect their lenses is in order to decrease the likelihood of getting an eye infection. Using the results of this study, a consumer will be able to make an informed choice when selecting a contact lens solution.

METHODS:

Supplies-

Petri dishes (28)	Paper discs
Glass pipets	Sterile cotton-tip applicators
Auto-pipets	Glass test tubes
McFarland #5 Standard	Sterile saline
Sterile tweezers	

Organisms – *Pseudomonas aeruginosa*, *Staphylococcus epidermis*, *Candida albicans*

Multipurpose No-Rub Solutions –

Solution	Disinfectant(s)
Solo Care Plus (Ciba)	Polyhexanide (PHMB) – 0.0001%
Opti-Free Express (Alcon)	Polyquad (polyquaternium-1) – 0.001%
Renu Multiplus (Bausch & Lomb)	Dymed (polyaminopropyl biguanide) – 0.0001%
Clear Care (Ciba)	Hydrogen Peroxide – 3%

Media- Tryptone soy broth (TSB), MH agar, Sabouraud dextrose agar, Sabouraud dextrose broth

Procedure-

- 1) Acquire microorganisms from Ferris State University Microbiology Department
- 2) Prepare MH and Sabouraud agar plates: 20 MH plates, 10 Sabouraud plates
- 3) Grow organisms in appropriate broth: *Pseudomonas aeruginosa* and *Staphylococcus epidermis* in TSB and *Candida albicans* in Sabouraud
- 4) Incubate for 24 hours
- 5) Dilute broth with saline to visually equal McFarland #5 Standard (10^5 cells/mL)
- 6) Using a cotton-tipped applicator, spread microorganisms on appropriate agar plates (full field): *Pseudomonas aeruginosa* (10 plates) and *Staphylococcus epidermis* (10 plates) on MH agar and *Candida albicans* (10 plates) on Sabouraud agar
- 7) Use sterile tweezers to apply a paper disc to the center of each plate
- 8) Using an auto-pipet, instill 35 μ L of each contact lens solution onto two paper discs per organism
- 9) Prepare two control plates for each organism by instilling 20 μ L of sterile saline onto each control plate disc with an auto-pipet
- 10) Incubate all plates at 35°C ambient (regular atmosphere) for 24 hours
- 11) Measure the radius of the zones of inhibition on each plate with a millimeter ruler starting from the edge of the disc to the edge of the zone

RESULTS:

The results of the experiment are summarized in the table below. The zones of inhibition are specified in millimeters. A partial result indicates a thinning of the growth rather than a complete absence.

Organism	Opti-Free	Renu	Solo Care	Clear Care	Control
<i>P. aeruginosa</i> 1	1.5 partial	3.0 partial	0.0	16.0	0.0
<i>P. aeruginosa</i> 2	1.5x3.0 partial	2.0 partial	1.0 partial	16.0	0.0
<i>S. epidermis</i> 1	0.0	0.0	0.0	28.0	0.0
<i>S. epidermis</i> 2	0.0	0.0	0.0	30.5	0.0
<i>C. albicans</i> 1	0.0	0.0	0.0	15.5	0.0
<i>C. albicans</i> 2	0.0	0.0	0.0	15.0	0.0

DISCUSSION:

The results of this experiment are based on the clear zones of inhibition created by the disinfectant of each solution. The larger the radius of the zone, the greater the disinfectant properties towards that particular organism. All four solutions should be equally effective against each microorganism. However, if one is better than the others, it will yield the largest clear zone of inhibition.

The Clear Care solution showed the greatest disinfectant capability compared to the rest. All solutions showed some disinfectant properties towards *Pseudomonas aeruginosa*. However, Opti-Free, Renu, and Solo Care Plus did not show any disinfectant capabilities towards *Staphylococcus epidermis* and *Candida albicans*.

This study is comparable to the “Stand-Alone” procedure for disinfecting products described by the FDA.² It is important, however, to consider the fact that the solutions were not tested in the environment for which they are created. According to the

FDA experimentation guidelines “The products should be used in the manner and quantity recommended in product labeling and/or patient instructions.”² In other words, a more specific study should include the solutions being tested against a realistic number of organisms and on an actual contact lens. Such a study is described in the FDA guidelines for disinfection efficacy testing.²

In summary, the experiment was intended to show which of the four no-rub multipurpose solutions was more effective against the challenge organisms in hopes that this information could be applied towards consumer purchases. The goals of multipurpose contact lens solutions include disinfection as well as minimizing ocular tissue damage, discomfort, and adverse reactions.³ Of these, one can argue the most important characteristic of a contact lens solution is its disinfectant properties. The results of this study may help in that decision. However, future experiments will need to be performed to obtain more usable information.

REFERENCES

1. Hom, Milton M. O.D., F.A.A.O. ed. Manual of Contact Lens Fitting with CD-ROM. Boston: Butterworth & Heinemann, 2001.
2. U.S. Food and Drug Administration, Center for Devices and Radiological Health. www.fda.gov/cdrh/ode/contlens.pdf ; pgs 94-109
3. Lubricating and rewetting solutions: A roundtable discussion. Par II. CL Spectrum 1989;4(5):47-52