Comparative disinfectant efficacy of Purilens versus ReNu

Xuan Pham
Pacific University

Recommended Citation
Pham, Xuan, "Comparative disinfectant efficacy of Purilens versus ReNu" (2000). College of Optometry. 1355.
https://commons.pacificu.edu/opt/1355

This Thesis is brought to you for free and open access by the Theses, Dissertations and Capstone Projects at CommonKnowledge. It has been accepted for inclusion in College of Optometry by an authorized administrator of CommonKnowledge. For more information, please contact CommonKnowledge@pacificu.edu.
Comparative disinfectant efficacy of Purilens versus ReNu

Abstract
The disinfectant efficacy of Purilens and ReNu Multiplus Multi-purpose solution was compared against Staphylococcus aureus, Pseudomonas aeruginosa and Candida albicans. About 10,000 colony forming units (cfu/ml) of each challenge organism were added to the disinfecting solution. At the end of the disinfecting time, 15 minutes for Purilens and 4 hours for ReNu, the number of remaining microorganisms was determined. There was at least a 95% reduction of the initial number of challenge organisms for both systems. They are equally efficient in contact lens disinfecting. The advantage of Purilens is that it is more convenient due to the short period of disinfection of 15 minutes.

Degree Type
Thesis

Rights
Terms of use for work posted in CommonKnowledge.

This thesis is available at CommonKnowledge: https://commons.pacificu.edu/opt/1355
Copyright and terms of use

If you have downloaded this document directly from the web or from CommonKnowledge, see the “Rights” section on the previous page for the terms of use.

If you have received this document through an interlibrary loan/document delivery service, the following terms of use apply:

Copyright in this work is held by the author(s). You may download or print any portion of this document for personal use only, or for any use that is allowed by fair use (Title 17, §107 U.S.C.). Except for personal or fair use, you or your borrowing library may not reproduce, remix, republish, post, transmit, or distribute this document, or any portion thereof, without the permission of the copyright owner. [Note: If this document is licensed under a Creative Commons license (see “Rights” on the previous page) which allows broader usage rights, your use is governed by the terms of that license.]

Inquiries regarding further use of these materials should be addressed to: CommonKnowledge Rights, Pacific University Library, 2043 College Way, Forest Grove, OR 97116, (503) 352-7209. Email inquiries may be directed to: copyright@pacificu.edu

This thesis is available at CommonKnowledge: https://commons.pacificu.edu/opt/1355
COMPARATIVE DISINFECTANT EFFICACY OF
PURILENS versus RENU

By

Xuan Pham

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
for the degree of
Doctor of Optometry
May, 2000

Advisors:
Patrick Caroline
Diane Yolton, PhD, OD
COMPARATIVE DISINFECTANT EFFICACY OF
PURILENS versus RENU

Fall 1999

Advisors: Patrick Caroline

Diane Yolton, PhD, OD

Submitted by: Xuan Pham
BIOGRAPHY

Xuan T. Pham- Xuan grew up in Vietnam. She came to the United State in 1990 and started her college education in 1991 at Evergreen Valley College in San Jose, CA. She received her B.S. degree in Biochemistry from University of California at Davis in 1995. She goes on to pursue an O.D. degree at Pacific University College of Optometry. Upon graduation, Xuan will return to San Jose, CA, to practice optometry.
ABSTRACT
The disinfectant efficacy of Purilens and ReNu Multiplus Multi-purpose solution was compared against Staphylococcus aureus, Pseudomonas aeruginosa and Candida albicans. About 10,000 colony forming units (cfu/ml) of each challenge organism were added to the disinfecting solution. At the end of the disinfecting time, 15 minutes for Purilens and 4 hours for ReNu, the number of remaining microorganisms was determined. There was at least a 95% reduction of the initial number of challenge organisms for both systems. They are equally efficient in contact lens disinfecting. The advantage of Purilens is that it is more convenient due to the short period of disinfection of 15 minutes.
INTRODUCTION

Million of people in the United State wear contact lenses. Most of these contact lenses usually require a care system composed of two steps: digital cleaning followed by disinfection. Microbial corneal infection is a serious complication of contact lens wear, especially hydrogel contact lens wear. Lens care regimen should keep this complication at the minimal level. Unfortunately there are many drawbacks to the current methods of disinfection of contact lens. Heat disinfection is not recommended for many high-water content contact lenses. This method can alter the lens parameters and reduce the life span of the lenses. In addition, 30% users of thermal disinfection may not perform proper disinfecting technique. Chemical disinfectants are expensive. Many contact lens wearers do not throw away their old lens cases and have contaminated contact lens care systems. The preservatives in the chemical disinfectants can also cause hypersensitivity reactions in 5 to 30% of patients. The hydrogen peroxide systems are also very expensive and required separated bottles of solutions. They are also ineffective against some fungi and Acanthamoeba species.

To overcome the limitations of chemical disinfectants, manufactures of contact lens solution have developed disinfectants that are able to effectively disinfecting contact lens over a short period of time with minimal amount of potentially harmful chemical agents exposed to the eyes. Purilens is a new contact lens cleaning and disinfecting system. It is the combination ultrasonic cleaning/ultraviolet disinfecting system and has a complete disinfecting cycle of 15 minutes. The subsonic turbulence is used to replace the traditional digital cleaning, and the ultraviolet light exposure replaces the chemical disinfectant. The ultraviolet light is absorbed by deoxyribonucleic acid in any contaminating organisms and causes cross linking and breaking of nucleic acid bonds. This leads to cell death.

To determine the disinfectant efficacy of Purilens system (Purilens, Inc.), this system was compared with ReNu Multiplus Multi-purpose Solution (Bausch & Lomb), a chemical disinfectant. The challenge organisms, Staphylococcus aureus (ATCC 6538), Pseudomonas aeruginosa (ATCC 9027), and Candida albicans (ATCC 10231) were used because they have been associated with contact lens related infection.

MATERIALS AND METHODS

Two Purilens systems were used to test, in sequence, the disinfectant efficacy against S. aureus, P. aeruginosa, and C. albicans. A cycle of blank disinfection (without any organism) was run in between testing trials. Three ReNu Multiplus Multi-purpose Solution starter kits were used to test for the efficacy of ReNu system. Two trials were run using each kit per organism. One well of ReNu lens case and one Purilens unit were used per testing trial of each disinfectant.

The “zero-time” sample was collected just after the organism was first added into the disinfecting solution. The “end-time” sample was collected at the end of the recommended disinfecting time for the system which were 15 minutes
for Purilens and four hours for the ReNu. At these time points, the number of microorganisms present in each solution was determined and comparison of the numbers was used to determine disinfectant efficacy of the two systems.

A. Preparation of media:
Agar plates, Trypticase Soy Agar (TSA) for S. aureus and P. aeruginosa and Sabouraud Dextrose Agar (SDA) for C. albicans, were prepared two days prior to the experiment. Thirty two plates were needed for each organism (2 trials, x 2 sample times, x 4 dilutions, x 2 disinfecting systems).
1. The dried media and deonized water were put in 2000 ml Erlenmeyer flasks, mixed and autoclaved at pressure and temperature for 30 minutes.
2. From the autoclave, the flasks were sat on the countertop to cool down before plate pouring.
3. The poured agar plates were air-cooled and dried on the counter top for 2 hours. Then they were coded denoting organism, trial number, and sample time and refrigerated until 2 hours before inoculation.
4. Physiological saline solution was prepared at 0.8% concentration and autoclaved. Saline solution was divided into 9 ml aliquots in sterile test tubes. These test tubes were labeled denoting diluting concentration and stored in racks in groups of four, to avoid any confusion during the experiment.

B. Preparation of inocula:
The organisms used were shipped from ATCC in the dry form in glass vials. They were rehydrated with saline and plated.
1. After 24 hours of incubation at 30-35°C, six streak plates were prepared from the rehydrated organisms and incubated at 30-35°C for 24 hours to provide isolated colonies.
2. On the day of the experiment, isolated colonies were harvested with a sterile cotton swab moistened with sterile saline and transferred to a test tube containing sterile physiological saline. The tube was vortexed, with the swab rotating freely. The process was repeated until the media appear turbid and milky in appearance. The initial concentration of the organism of approximately $10^8$ colony forming units per milliliter (cfu/ml) was estimated by spectrophotometer. The setting of the spectrophotometer was at 620 nm wavelength, and the designed absorbance reading was 1.5.

C. Inoculation of testing organisms:
The vials of inocula were vortexed to ensure all bacteria were in suspension. An appropriate amount of inocula was withdrawn from the inocula vial and added to the disinfecting solution to give $10^6$ cfu/ml at the initial time of disinfecting period. To obtain this concentration, 130 ul of sample was added to 13 ml of Purilens solution in the Purilens lens holder and 30 ul of sample was added to 3 ml of ReNu disinfecting solution in a well of a contact lens case. The total volume for each system was determined according to the volume recommended by the package inserts for proper disinfection.
D. Serial Dilution and Plating
1. As soon as the sample was added into the disinfecting solution, the disinfecting well was agitated to ensure well mixing of the inocula. Then 1ml of sample was extracted from the disinfecting well by 1ml pipette and added to 9ml of sterile saline solution. This is a 1/10 dilution, and the concentration is $10^5$ cfu/ml. This is the zero time point of the disinfecting process.

2. The test tube containing $10^5$ solution was vortexed. Using an Ependorf pipette, an aliquot of 100 ul of $10^5$ solution was withdrawn and added to the appropriate agar plate. The sample was spreaded on the agar plate with a sterile glass rod. This represents $10^4$ cfu/ml concentration of the tested organism in the first agar plate of the diluting series.

3. Another aliquot of 1ml of $10^5$ solution was extracted by using a new 1ml pipette and added to another test tube contained 9ml of sterile saline solution. This represents a concentration of $10^4$ cfu/ml. The process described in step (2) was repeated 3 more times, using new 1ml pipette and Ependorf pipet tip each time to obtain plates with concentration of $10^3$, $10^2$ and $10^1$ cfu/ml.

E. Plate counts
Plates were allowed to sit upright to dry until no liquid was detectable on the surface of the agar. At that point, plates were inverted and transferred to a temperature controlled incubator at 30-35°C for 24 hours. Plate counts are determined by visually counting the number of cfu per plate. Bacteria plates that were determined to be to numerous to count (TNTC) were recorded as greater than 300. Bacterial plates that were too few to count (TFTC), or showed no growth at all, were recorded as less than 30 cfu.

RESULTS
The numbers of cfu were determined for each disinfecting well at the beginning and at the end of disinfecting period. This would give the comparison of the efficacy of Purilens and ReNu against the challenge organisms. The results of the efficacy of these disinfecting systems and the percent reduction of microorganisms is summarized in the table.

At the end of the disinfecting periods, there are significant reductions of all challenge organisms by both disinfecting systems. There is at least 95% reduction of micro-organisms at the end of disinfecting period of both disinfectants. Even though the results are similar in both trials of testing, the experiment consists a small size of testing trials due to limitation of time and resources.

DISCUSSION
Purilens disinfecting system has the same efficacy as ReNu. The results of this experiment suggested that Purilens is a more convenient disinfectant due to its short disinfecting period and its lack of needing digital cleaning prior to
disinfection. Although regular cleaning of contact lens is an important part of contact lens care, only one third of contact lens wearers actually clean their lenses upon removal. At the present, there is no disinfecting system available in the United States that does not require digital cleaning before disinfection. According to one clinical trial on the safety of Purilens system, there was no severe eye complication, no lens intolerance and reduced wearing time. Eighty seven percent of patients like the system as indicated in their responses to a questionnaire at the end of the study. However, there are also drawbacks of this system. First is unit malfunction. Second, accumulative exposure to ultraviolet light can alter lens parameters such as power, center thickness, diameter and water content. These changes are greater in group II contact lens, which is the high water content, nonionic group. These changes can affect lens fitting, performance and comfort level of lenses on patients' eyes. The efficacy of the two disinfecting systems were tested under the condition that the inocula of microorganisms were put directly into the solution. There was no comparison of the effectiveness between mechanical rubbing of contact lens and subsonic turbulence of Purilens system. This aspect needs further investigation. Purilens system provides hope that a simple one-step lens cleaning and disinfection is within reach. This would encourage compliance by contact lens wearers as well as reduce contact lens related complications.
REFERENCE


ACKNOWLEDGEMENTS

I would like to thank my advisors, Dr. Diane Yolton and Mr. Patrick Caroline for their wisdom and guidance throughout this project.
I would like to thank Purilens, Inc. for providing the disinfecting units for the experiment and Pacific University College of Optometry for the use of their facilities and resources to make this project happen.
I would also like to thank my friends, especially Tanya Klassen and Staci Perea, for their care and support during the course of this experiment.
Number of surviving challenge organisms and percent reduction at the end of disinfecting cycle

<table>
<thead>
<tr>
<th></th>
<th>C. albicans</th>
<th>P. aeruginosa</th>
<th>S. aureus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>zero time</td>
<td>end time</td>
<td>% reduction</td>
</tr>
<tr>
<td>ReNu</td>
<td>39000*</td>
<td>300</td>
<td>99.2</td>
</tr>
<tr>
<td></td>
<td>32,000</td>
<td>600</td>
<td>98.1</td>
</tr>
<tr>
<td>mean</td>
<td>35,500</td>
<td>450</td>
<td>98.7</td>
</tr>
<tr>
<td>Purilens</td>
<td>25,000</td>
<td>100</td>
<td>99.6</td>
</tr>
<tr>
<td></td>
<td>29,000</td>
<td>100</td>
<td>99.7</td>
</tr>
<tr>
<td>mean</td>
<td>27,000</td>
<td>100</td>
<td>99.6</td>
</tr>
</tbody>
</table>

*Cfu (colony forming units)/ml