A comparative study of Flurocaine and Fluress in Goldmann tonometry

Marie A. Kernie
Pacific University

Gretchen A. Proehl
Pacific University

Recommended Citation
https://commons.pacificu.edu/opt/888

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.
A comparative study of Flurocaine and Fluress in Goldmann tonometry

Abstract
Two products, Fluress and Flurocaine, were compared for comfort upon instillation of the drops, brightness of the rings, and the width of the rings. One drop of one product was put in one eye and one drop of the other product was put in the other eye. The subjects were then asked to compare the comfort of one product to the comfort of the other. The experimenter measured intraocular pressures using the Goldmann aplanation tonometer and evaluated the brightness and width of the rings. The results indicate Fluress is significantly more comfortable and produces brighter rings but there is no significant difference in the width of the rings.

Degree Type
Thesis

Rights
Terms of use for work posted in CommonKnowledge.

This thesis is available at CommonKnowledge: https://commons.pacificu.edu/opt/888
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/888
A COMPARATIVE STUDY OF FLUROCAINE AND FLURESS IN GOLDMANN TONOMETRY

By
MARIE A. KERNIE
GRETCHEN A. PROEHL

A thesis submitted to the faculty of the College of Optometry Pacific University Forest Grove, Oregon for the degree of Doctor of Optometry May, 1989

Adviser
Lee Ann Remington, O.D.
SIGNATURE PAGE

Authors:
Marie A. Kernie
Gretchen A. Proehl

Adviser:
Lee Ann Remington, O.D.
Marie Kernie received her Bachelor of Arts degree in Biology from Carroll College in Helena, Montana in 1985. She then attended optometry school for four years at Pacific University in Forest Grove, Oregon. Her future goal is to go into private practice and specialize in primary care optometry.

Gretchen Proehl completed three years of pre-optometry at Viterbo College in LaCrosse, Wisconsin before transferring to optometry school at Pacific University in Forest Grove, Oregon. She received her Bachelor's of Science degree in Visual Science in 1987 from Pacific University. Future goals are to become established in a private practice and specialize in vision therapy and developmental vision.
ABSTRACT

Two products, Fluress and Flurocaine, were compared for comfort upon instillation of the drops, brightness of the rings, and the width of the rings. One drop of one product was put in one eye and one drop of the other product was put in the other eye. The subjects were then asked to compare the comfort of one product to the comfort of the other. The experimenter measured intraocular pressures using the Goldmann aplanation tonometer and evaluated the brightness and width of the rings. The results indicate Fluress is significantly more comfortable and produces brighter rings but there is no significant difference in the width of the rings.

KEY WORDS

Goldmann tonometry, Flurocaine, Fluress, proparacaine, benoxinate, thimerosal, chlorobutanol
INTRODUCTION

Goldmann applanation tonometry is considered to be one of the most accurate ways to measure the intraocular pressure of the eyes. It requires the application of two solutions. One is a topical anesthetic to decrease the blink reflex of the eye and the other is the dye, fluorescein, to accurately determine when the standard 3.06 mm of the cornea has been appplanation.

Two major techniques are used to apply these. One is a two step process: first the anesthetic is applied and then the fluorescein from either a sterile solution or an impregnated strip is applied. It is, however, sometimes difficult to achieve a consistent degree of fluorescence with application of fluorescein in this two step process and thus tonometry readings may be somewhat variable.

The other technique is to use one solution containing both an anesthetic and fluorescein. Efficiency is increased using this method by eliminating the need for separate applications of anesthetic and fluorescein and more consistent fluorescence is achieved thus allowing reproducible intraocular pressure determinations.

At this time two products designed for applanation tonometry are available. One is Fluress, developed by Barnes Hind company and the other is Flurocaine, distributed by Medical Ophthalmics company. Both have the advantage of combining an anesthetic and fluorescein into one solution. They are different, however, in terms of the anesthetic and the preservative they contain. Fluress contains .4% benoxinate as an anesthetic and 1% chlorobutanol as a preservative. .5% proparacaine is the anesthetic in Flurocaine and .01% thimerosol is used as the preservative.

Both preparations contain povidone which prevents precipitate formation. In Fluress, povidone additionally allows a higher than usual concentration of chlorobutanol to be used. Both preparations contain .25% fluorescein sodium which is considered to be the ideal concentration for obtaining maximal fluorescence. Obtaining maximal fluorescence is important because measurement of intraocular pressure with Goldmann tonometry requires that the meniscus of tear fluid surrounding the flattened corneal surface be sufficiently stained with fluorescein so that the apex of the wedge-shaped meniscus is visible. If the fluid apex is not visible, the apparent flattened area of the cornea will consist of a smaller than standard flattened surface of cornea plus a rim of invisible tear fluid and this will result in an underestimation of intraocular pressure.

Both benoxinate and proparacaine cause quenching of fluorescein. Lyle et. al. report that benoxinate produces less quenching, however their source is not indicated. Moses did a study which indicated that .2% benoxinate had less quenching effect than .5% proparacaine. However, there was no comparison with .4% benoxinate, the amount found in Fluress. Another study by Tanton rated the fluorescent rings in 78 out of 110 patients as excellent in terms of diameter being 1/10 of the total diameter of the rings and the edges being sharp. In this study a combination of .44% proparacaine and .25% fluorescein was used. No sources were found comparing the quenching effect of .5% proparacaine versus .4% benoxinate.

Patient comfort upon instillation is another desirable characteristic which a fluorescein anesthetic combination solution should provide. The studies done indicated that .4% benoxinate has a
tendency to sting slightly more than .5% proparacaine upon instillation. Thimerosol, (the preservative in fluoroacaine), however, is known to cause irritation in many. Mondino et al. estimate a 6.6-8% thimerosal hypersensitivity in the United States. Chlorobutanol (the preservative in Fluress) has not been reported to cause this problem. A stinging sensation may also be noticed with Fluorescein application, due to another of its components, glycerin, which has a hyperosmotic effect.

Cost comparison showed Fluress to be nearly twice as costly as Fluoroacaine. This study will compare these two products in terms of comfort upon instillation, fluorescence of the rings, and accuracy and consistency of the width of the rings.

METHODS

The study involved a double blind experiment in which the labels of the two products were disguised. The bottles appeared the same and identical droppers were used. One bottle was randomly labeled "1" and the other "2." The fluoroacaine product was refrigerated prior to experimentation in accordance with manufacturer's instructions. A coin was flipped, "Heads" equaling "1" and "Tails" equaling "2," prior to administering the drops to determine which eye was to receive each product. The first experimenter flipped the coin and recorded which eye was to receive each numbered bottle. This controlled random administration of the products to the eyes.

The subject pool was obtained on a volunteer basis from the optometry school and a minimum of fifty subjects used. Those that were eligible reported no allergies to anesthetics, no ocular infections or recent ocular injuries.

Visual acuities were taken at the start of each measurement. Subjects wore their habitual prescription for a twenty foot distance. Corneal integrity was evaluated with the biomicroscope by the second experimenter. The evaluation included the assessment of corneal scarring, swelling, or infection that might contraindicate use of the Goldmann tonometer.

One drop of each product was administered by the first experimenter to the subject's eyes, right first and left eye second, based on the flip of the coin. The subject was immediately asked about the comfort of one drop compared to the other. The subject reported the more uncomfortable eye and the degree of discomfort was graded based on a scale presented to the subject. The scale was as follows:

Grade 1: Discomfort much greater than the other eye
Grade 2: Discomfort more uncomfortable than the other eye
Grade 3: No difference noted

The intraocular pressures were measured by the second experimenter using the Goldmann tonometer attachment for the biomicroscope. The right eye's pressure was measured first then the left eye second. The ring images of each eye produced by the fluorescein were evaluated based on brightness and ring width to ring diameter relationship. Those gradings were:
Ring Brightness Grading
Grade 1: Very Bright
Grade 2: Bright
Grade 3: Dull or Faint
Grade 4: Nothing

Ring Width Grading
Grade 1: Equal to 1/10 the total diameter
Grade 2: Less than 1/10 the total diameter
Grade 3: 1/6 to 1/4 the total diameter
Grade 4: Greater than 1/4 the total diameter

Corneal integrity was rechecked to be certain the superficial layers were not compromised. Visual acuities were measured to ensure that vision was the same as at the start of the testing. The subjects remained in a waiting area for fifteen minutes to ensure that no ocular discomfort was noticed when the anesthetic had worn off. The subjects were then dismissed.

RESULTS

The data for comfort upon instillation of the drops (see Table 1) indicates that 30% of the subjects distinguished no difference in sensation between the two solutions, 50% distinguished a slight difference and 20% distinguished a large difference. Among those who did distinguish a difference (70%), Fluress was found to be significantly more comfortable (Chi² = 5.25, df = 1, p < .05).

The Mann-Whitney statistical test indicates that Fluress produced significantly brighter rings (Z = 3.785, p < .05), however, there was not a significant difference between the two products concerning ring width accuracy and consistency. Tables 2 and 3 summarize this data.

TABLE 1: SUBJECT COMFORT

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLURESS</td>
<td>1</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>FLUROCAINE</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>NO DIFFERENCE</td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

A: indicates much greater difference in comfort  B: indicates a greater difference in comfort  C: indicates no difference

TABLE 2: RING FLUORESCENCE

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLURESS</td>
<td>17</td>
<td>25</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>FLUROCAINE</td>
<td>4</td>
<td>21</td>
<td>23</td>
<td>2</td>
</tr>
</tbody>
</table>

A: very bright  B: bright  C: dull or faint  D: nothing
TABLE 3: RING WIDTH

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLURESS</td>
<td>14</td>
<td>26</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>FLUROCAINE</td>
<td>32</td>
<td>13</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

A: equal to 1/10 the total diameter  B: less than 1/10 total diameter  C: 1/6 to 1/4 total diameter  D: greater than 1/4 total diameter

DISCUSSION

The data indicates that there is a significant difference between Fluress and Flurocaine in two of the areas tested. Fluress was shown to provide greater comfort and brightness, whereas there was no significant difference between the two products in regard to ring width.

The difference in subject comfort between the two products may be attributed to the different preservatives used in each item. Though benoxinate in Fluress produces greater stinging than proparacaine, the irritation due to thimerosal in Flurocaine may perhaps outweigh the stinging effect of benoxinate. The other component in Flurocaine, glycerin, may also contribute to the increased discomfort. It should be emphasized that this conclusion is based only on those subjects that did indicate a difference in comfort between each eye.

The difference in ring brightness may be attributed to quenching effects of the fluorescein by the anesthetics. Proparacaine has been indicated to possibly produce greater quenching effects on fluorescein than benoxinate. A comparative analysis between .4% benoxinate and .5% proparacaine each combined with .25% fluorescein should be done to support this explanation that the fluorescein in Flurocaine is quenched more than in Fluress. The preservative in Flurocaine, thimerosal, may have an unknown quenching effect to contribute to the decreased fluorescence.

The insignificant difference between the two products with regard to ring width may be a factor of the component povidone used in both products as a wetting agent. Povidone stabilizes the interaction between the anesthetic and fluorescein. Ring width is critical for consistent intraocular pressures measurements. According to this study, both products can be considered to provide consistent measurements of intraocular pressures.

Further studies addressing these concerns should consider a different rating system in which the subject rates the comfort of each drop individually instead of reporting the more uncomfortable eye and to what degree. Corneal sensitivity is another aspect which may differ among individuals and may need to be a consideration.

Both products provide consistent intraocular pressure measurements, however Flurocaine is generally found to be half the cost of Fluress. The doctor's decision must weigh the savings in cost against the discomfort and fluorescence ability in order to determine which product is best to select.
ACKNOWLEDGEMENTS

The researchers of this experiment would like to thank Barnes Hind Company and Medical Ophthalmics Company for donating their products of Fluress and Fluocaine, respectively. It is also indicated to thank our adviser, Lee Ann Remington, O.D., for overseeing this project and providing insight in our procedure. Thank you is also in order for Bradley Coffey, O.D in assisting us in analyzing our data correctly.
REFERENCES


