A comparison of training time for teaching optometric technicians how to perform Goldmann Applanation Tonometry and Keeler Pulsair 3000

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Abstract
Goldmann Applanation Tonometry (GAT) has long been considered the "Gold Standard" method of measuring intraocular pressure. However, it may be somewhat complex and lengthy for a doctor to teach his staff members. It is proposed in this thesis project that it would be less time-consuming to train naive subjects to adequately perform tonometry using the Keeler Pulsair 3000 (KP3) versus Goldmann Applanation Tonometry. Ten subjects were timed on the length of time it took to learn each apparatus. Each subject was then asked to complete a questionnaire at the end of the lesson. The results showed that the KP3 required half the amount of time to learn than the GAT. Subject response to the questionnaire was in favor of the KP3. Because the Keeler Pulsair 3000 requires less training time and is easier to perform, it may serve as a good screening tool for optometrists in their practices.

Degree Type
Thesis

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A COMPARISON OF TRAINING TIME FOR TEACHING OPTOMETRIC TECHNICIANS HOW TO PERFORM GOLDMANN APPLANATION TONOMETRY AND KEELER PULSAIR 3000

BY
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AND
SHERILYNE M. TARUMOTO

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
For the degree of
Doctor of Optometry
May 2001

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Jesse Standish was born and raised in Anaconda, Montana. He attended local schools there and graduated high school in 1991. He attended Pacific University where he received Bachelor of Science degrees in Biology and English Literature. After a year off from school, Jesse attended the University of Montana, where he received a degree in Microbiology. Jesse is currently in his fourth year of optometry school at Pacific University, where he will graduate in May 2001. Long term plans hope to bring him back to Montana to practice optometry.

Sherilyne Tarumoto was born in Honolulu, Hawaii. She attended the University of Hawaii where she graduated with a Bachelor of Arts degree in Biology. Currently, she is in her fourth year at the Pacific University College of Optometry. Sheri will be graduating in May 2001. Her future plans are to return to Hawaii to practice optometry.
Goldmann Applanation Tonometry (GAT) has long been considered the "Gold Standard" method of measuring intraocular pressure. However, it may be somewhat complex and lengthy for a doctor to teach his staff members. It is proposed in this thesis project that it would be less time-consuming to train naïve subjects to adequately perform tonometry using the Keeler Pulsair 3000 (KP3) versus Goldmann Applanation Tonometry. Ten subjects were timed on the length of time it took to learn each apparatus. Each subject was then asked to complete a questionnaire at the end of the lesson. The results showed that the KP3 required half the amount of time to learn than the GAT. Subject response to the questionnaire was in favor of the KP3. Because the Keeler Pulsair 3000 requires less training time and is easier to perform, it may serve as a good screening tool for optometrists in their practices.

Keeler Pulsair 3000, Goldman Applanation Tonometry, intraocular pressure
**Introduction**

Tonometry is performed on patients as one of several important screening or diagnostic tests to detect glaucoma, an ocular condition where the intraocular pressure (IOP) may increase above normal levels. The Keeler Pulsair and Goldmann Applanation Tonometry (GAT) have been shown to correlate well\(^1\:\^2\:\^3\). With the increasing use of technicians in optometric and ophthalmological practices, the need for an easy to use, quick to learn method for screening IOP is desirable. In this study, we will compare the training time needed, along with comfort level, to teach new subjects in using both GAT and KP3 instruments.

**Methods**

Ten subjects were timed for the length of time it took to learn and adequately perform Goldmann Applanation Tonometry versus the Keeler Pulsair 3000. The ten subjects were divided into five groups of two. Criteria parameters for this study were that all subjects involved had had no previous experience at all with any form of intraocular pressure measurements. One instructor provided the training for each group of two subjects. Each subject was asked to complete a questionnaire at the end of the lesson (See Appendix 1).

Training for the use of GAT and KP3 involved one instructor and two subjects. Since GAT is the gold standard for which all other IOP techniques are gauged, it was the first of the two procedures taught.

Timing for GAT started at the beginning of the demonstration and explanation of the procedure. The first technician sat in the examination chair, assuming the role of patient, while the instructor washed his hands. The GAT probe was disinfected with commercial hydrogen peroxide, rinsed with sterile saline, and then inserted into the spring-loaded control box mounted onto the slit lamp. The white mark was aligned with the 180-degree mark. Subjects were educated about what to do with patients with corneal cylinder amounts greater than three diopters. In these instances, the red mark on the probe holder must align with the patients minus cylinder axis of the probe, as previously documented in the patient’s refraction.

The subject was given a facial tissue, instructed to tilt his head back, and look up. Using sterile technique, one drop of Proparacaine
0.5% ophthalmic solution was inserted into each globe's lower cul-de-sac. The subject was instructed to gently close his eyelids. A sterile fluorescein sodium ophthalmic strip was opened and one drop of sterile saline was placed on the tip. The subject was instructed to open his eyes, and look up. The fluorescein strip was then gently touched to the inferior bulbar conjunctiva.

The slit lamp was moved in front of the subject at a comfortable height. The subject was told to put his chin on the chin-rest, stressing the importance of keeping his forehead in constant contact with the headrest. The eyepieces were positioned straight ahead, the illumination source at approximately 60 degrees, cobalt-blue filter in, illumination wide open and at its maximum source, and magnification at 6X.

With the subject positioned properly, a quick scan of both corneas was done to ensure that they were healthy and that GAT was permissible. After this, the GAT control box was moved into its straight-ahead position with the drum set at 1. Care was taken to inform the observing subjects that both the control box and the probe mount must be in their click stop positions. The subject was instructed to fixate on a spot directly behind the examiner at his or her own eye level. The slit lamp system was moved forward toward the subject’s right eye. The illumination system was positioned to the left. The probe was pushed forward to about one inch of the subject’s globe, just slightly inferior to the center of the cornea. The subject was instructed to blink and then try to refrain from blinking for a few seconds. The slit lamp system was then pushed forward with the lamp's joystick until the spring-loaded probe appplanationed the cornea by gently springing back. The image of the two fluorescent green semicircles was then viewed through the left ocular. The joystick was positioned with one hand while the other turned the measuring drum until the inner border of the semicircles just touched. The observing subject was then allowed to view the aligned image through the left ocular. The joystick was moved vertically to show the observing subject an off-centered image. Both subjects were instructed to move the joystick in the direction of the larger semicircle until both were equally viewed. The probe was then pulled back off the subject's cornea. The number on the measuring drum was read and multiplied by 10 for the correct IOP measurement in mmHG. Correct IOP measurements were observed by the instructor using a teaching scope. Educational advice was delivered about correct mire images.

The illumination system was then moved to the patient’s left eye and the procedure was repeated. After a correct IOP reading was
obtained on the left eye, the tonometer was positioned out to the side of the slit lamp so that both corneas could be checked for staining.

The two subjects then switched positions. The observing subject became the patient and the first patient became the observer. The demonstration was repeated for the new observing subject. Clinical pearls were given at the conclusion of the demonstration. Textbook pictures and drawings of aligned and misaligned mires were also shown to the subjects using *Atlas of Primary Eye Care Procedures.*

After the demonstration, the subjects performed the entire procedure on each other. Advice and instructions were given when needed throughout the entire procedure. Each subject performed adequate GAT on both eyes to instructor satisfaction before the timer was stopped. Time was not stopped for questions or instructions.

The KP3 was demonstrated following GAT instruction. The subjects were shown the KP3 model and a simple overlay of its parts. A diagram from the Keeler Company, consisting of one correct and numerous incorrect views, were presented. Corrective measures were listed below the pictures of each incorrect view. Each subject was shown how to turn the instrument on and initiate a demonstration test to insure that the KP3 instrument was properly calibrated.

There was a demonstration of the procedure using the teaching eye provided by Keeler, and also a demonstration on a human subject. The observing subjects were advised to inform their patients that a puff of air was going to be blown into their eyes. They were instructed to hold the KP3 13-16mm from the patient, using their other hand as a guide. Each subject then asked the patient to focus on the red fixation light in the instrument. The subject was then told to focus and center the red fixation lights as shown on the diagram and the KP3 would automatically fire once perfectly aligned. Four simultaneous readings were required for an accurate average. Each subject was then taught how to read the displayed measurements. Time was allowed for questions and additional advice. Timing was stopped when four accurate results were obtained, in accordance with clinical optometric standards, and each subject felt confident using the Keeler Pulsair 3000.
Results

Table 1. Recorded times to learn and perform the KP3 and GAT

<table>
<thead>
<tr>
<th>Group #</th>
<th>KP3 timed minutes</th>
<th>GAT timed minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>61</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>46</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>23</td>
<td>45</td>
</tr>
<tr>
<td>Average Results</td>
<td>24.8 min</td>
<td>50.4 min</td>
</tr>
</tbody>
</table>

The average amount of time to learn and adequately perform tonometry using the Keeler Pulsair 3000 was 25 minutes while the average time for Goldmann Applanation Tonometry was 50 minutes.

When asked which method of measuring IOP felt most comfortable to use as a new instrument, nine of the new subjects answered KP3 and one voted for GAT. Four subjects preferred having the KP3 performed on them, while six preferred GAT. When asked the advantages of the KP3, responses were “quick” (6), “convenient” (3), “easy to learn” (7), “no drops needed” (1), and “less invasive” (2). The only disadvantages of the KP3, listed by all ten subjects, were difficulty with alignment of the red fixation lights, and not liking a puff of air blown into their eyes. The left eye was observed by the instructor as being more difficult to obtain pressure readings than that of the right. This was postulated to be secondary to the fact that patients were more apprehensive to the puff of air after just having the KP3 administered on the right eye. Advantages listed for GAT were “easier to perform” (4) and “patient comfort” (6). The disadvantages named were “patient apprehensiveness” (4), “difficulty with the alignment of the mires” (2), and “fear of damaging the cornea” (7).

Discussion

It is less time-consuming to train naïve subjects to adequately perform tonometry using the Keeler Pulsair 3000 than Goldmann Applanation Tonometry. The subjects took an average of 25 minutes to adequately learn and perform tonometry using the Keeler Pulsair 3000. This was two times faster than when learning the Goldmann Applanation
Tonometry method. While training for the GAT took longer, and initial comfort with instrument use was much lower (9 to 1 preferred KP3 over GAT), we must not conclude that KP3 would be better for use by technicians based on this data. Even though the statement "twice as long to train" sounds like a big difference, we are talking of a time frame of only 25-30 minutes. In terms of training a person for long term employment, the addition of one-half hour extra training time is insignificant. It is also our opinion that comfort with GAT use would increase rapidly as the instrument is used more frequently. No follow-up was done to support this statement.

In conclusion, naïve subjects learned both techniques quite easily. While the time for learning was 100% different, the actual time would be clinically insignificant. Doctors should feel secure that both techniques can be learned well within a short period of time, and be utilized with accuracy and safety.

Acknowledgements

We would like to thank Keeler for generously donating the Keeler Pulsair 3000 to the Pacific University College of Optometry so that we could conduct our thesis project.

References


Appendix 1

Tonometer Preference Questionnaire

1. Which new method of measuring IOP do you feel most comfortable performing?
   a. Goldmann Applanation Tonometry
   b. Keeler Pulsair 3000

2. As a patient, which procedure was more comfortable?
   a. Goldmann Applanation Tonometry
   b. Keeler Pulsair 3000

3. What are the advantages and disadvantages of Goldmann Applanation Tonometry?

4. What are the advantages and disadvantages of the Keeler Pulsair 3000?