Assessment of the Ocular Disease Diagnostic Tutor as a Learning Tool

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Abstract

The Ocular Disease Diagnostic Tutor (ODDT) is a computer-based training (CBT) application that emphasizes the recognition and diagnosis of ocular disease. The ODDT is self-paced and deploys a decision-based approach to learning. In this study, the ODDT was used as a supplement to traditional classroom teaching. A randomized study was designed to evaluate whether or not use of the ODDT would improve student performance in the description, diagnosis and management of ocular disease. The evaluation demonstrated that the ODDT user group achieved an average of one standard deviation improvement in performance over tested material.

Key Words: *computer-based training, ocular disease, diagnosis, interactive, decision-based learning*

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Special thanks to Tony Cavallerano OD, Baharak Asefzadah, OD, MS, and Douglass Rhett, OD

The contents of this project were developed under a grant from the U.S. Department of Education. However, those contents do not necessarily represent the policy of the U.S. Department of Education, and you should not assume endorsement by the Federal Government.

Background

Over the past 20 years, the increase in scope of optometric practice has necessitated optometric clinicians to have a deep understanding of ocular disease. This, coupled with an explosion of medical knowledge, has led to a number of challenges within the optometric curriculum. The crowding of the curriculum makes it difficult to address the multitude of diseases that practicing clinicians are responsible for understanding. Additionally, optometric education is responsible for exposing students to less common, but sight-threatening ocular diseases. Although clinical experience is a key component to the understanding of disease, it is not possible for every clinician to experience the analytical process of differentiating between seldom-seen clinical entities. Clinical reasoning skills and critical observational skills are essential abilities in the practice of optometry, yet it is difficult to correctly diagnose and manage conditions that are rare or possibly encountered on a first-time basis. The Ocular Disease Diagnostic Tutor (ODDT) was developed to address these challenges in teaching ocular disease.

The ODDT is a computer-based training (CBT) application built on the premise that "decision-based learning" leads to better knowledge retention than passive text and graphic presentations.[1] The ODDT provides clinical challenges in a highly interactive, decision-based format. There are several ODDT modules covering retina, cornea, macular dystrophies and uveitis.

The program trains the ability to describe detailed clinical attributes of various ocular diseases. A major premise of the ODDT is that once the trainee can accurately identify specific pathologic attributes, the trainee can apply this knowledge to correctly diagnosing a particular ocular disease. In optometry, diagnosis of ocular conditions is highly dependent on visual analysis, and less dependent on laboratory findings. Therefore, it is essential that ocular disease attributes are correctly identified in a meaningful way so as to facilitate the pathway to a correct diagnosis.

The ODDT presents five major interactive screen interfaces. Four of the exercises are scored and recorded (# 2-5 in the list below). The major activities are:

1. Topic files: Text and graphic files with image interactions. The topic files provide background knowledge necessary for quiz and case questions. Additionally, these files are rich with images and unscored quiz questions.
2. Nomenclature exercises: A series of paired recognition exercises designed to introduce clinical-pathologic terminology.
3. Diagnostic cases: A series of 10-20 interactive exercises, which involve recollection and application of clinical terms, differential diagnosis and encyclopedic knowledge.
4. Reasoning cases: Another series of 8-10 interactive exercises that require students to analyze a case history, formulate a field of several diagnostic possibilities, identify and comment on pertinent case information, formulate a problem/plan list, read the case analysis and submit a self-assessment.
5. Interactive quizzes: These are scored computer-based quizzes with multiple choice questions, matching questions, fill in the blank, drag and drop, and hot spot interactions.

Progression through the program is based on problem-solving rather than reading and memorization. The exercises in the ODDT are increasingly complex and were developed in accordance with the Trivium classical academic approach of teaching (recognition, followed by recollection, followed by reasoning).[2]

Students monitor their progress via a screen that tracks their activities and marks each exercise as incomplete, complete or complete with extra credit. Students earn extra credit by scoring 80% or better on the first attempt. This is easy to do as the program allows them to look up the answers in the topic files while they are still in a quiz or case interaction. The extra credit mark provides an incentive for not arbitrarily selecting choices until the correct answer is found by process of elimination.

This study was designed to test the hypothesis that the ODDT improves performance in the areas of clinical description, diagnosis and treatment of ocular disease.

Methods

Sixty-nine students at the New England College of Optometry (NECO) participated in the study. All students were given a pre-test prior to entering their fourth-year clinical rotations. The exam was administered in five sections. Results were recorded on separate data sheets for each section. In section 1, students were given an 8x11 in. montage displaying four images. Students were asked to describe each of the four images in a clinically meaningful way. In section 2, students were asked to match pre-defined terms to the same set of images. In section 3, students were asked to list several conditions that should be considered in the differential diagnosis. In section 4, students were asked to analyze a correlating case history and then form a diagnosis and corresponding problem/plan. In section 5, students took a true/false factual knowledge test. The exam parts were given out and taken back in sequential order so as to prevent students from changing previous answers once more information was provided later in the test.

The ODDT program was given to fourth-year optometry students at four different Neighborhood Health Centers (NHC) in the greater Boston area. Students in their fourth-year are required to rotate to new clinic sites every three months. Data collection points occurred during summer, fall, winter and spring rotations. Each student was assigned to an NHC via a lottery, thus achieving randomization. During any given quarter, two sites were user groups and two sites were controls. The user sites were switched in order to avoid a site bias. In total, 38 students used the program and 31 students served as controls. At the conclusion of the study, both groups of students were given a post-test identical in format to the pre-test. The content of the post-test was necessarily different from the content of the pre-test. Students were notified about confidentiality and study protocols so as not to contaminate user and control populations. Two students were given clinical assignments that resulted in overlap between user and control populations. These students were not included in the statistical analysis.

All pre-tests and post-tests were graded in a blind fashion by an independent contractor. A precise scoring rubric was developed for scoring the examinations. The scoring rubric was applied to all pre-tests and post-tests. The tests were masked such that the grader did not know if a particular test was from a user or control study group. The user and control groups were balanced in terms of the quarter in which the post-tests were administered. In other words, there were approximately the same number of users and controls during each quarter to eliminate a learning bias.

Table 1.1
Group assignment (number of subjects), by semester

Group Assignment	Semester			
	1	2	3	4
Control	5	11	8	7
User	11	7	10	10

Table 1.2
Percent improvement, by section and assignment group

	Control		User	
	Mean	SD	Mean	SD
Section 1	1.163	16.192	13.1579	14.533
Section 2	-0.221	0.232	-0.0968	0.182
Section 3	-0.275	0.199	-0.1690	0.173
Section 4	-13.262	15.054	2.0671	20.294
Section 5	-0.907	10.771	2.7138	13.654
Overall	-9.693	10.415	2.1443	11.540

Table 1.3
Summary difference between groups, controlling for semester

	Mean	SE	p-val	95% CI	Eff. Size
Section 1	12.541	3.620	0.001	(5.45, 19.64)	0.77
Section 2	0.138	0.050	0.007	(0.04,0.24)	0.65
Section 3	0.112	0.046	0.017	(0.02,0.20)	0.59
Section 4	15.948	4.473	0.001	(7.18, 24.72	0.81
Section 5	4.173	3.140	0.189	(-1.98,10.33)	0.33
Overall	12.630	2.607	0.000	(7.52, 17.74)	1.01

Results

The results of the evaluation of pre-test and post-test scores showed a statistically significant difference between users and controls across sections 1-4, but not part 5. The greatest disparity between the user and control groups was seen in sections 1 and 4.

Section 1 measured the ability of students to correctly describe pathologic attributes of an image without any prompts. The mean score for the control group was 1.16 with a SD of 16.19, and the mean score for the user group was 13.16 with a SD of 14.53 (Table 1.2). The mean difference between users and controls was 12.54 at p-value 0.001 with an effect size of 0.77. Users could be expected to outperform controls between 5.45 and 19.64 points at a 95% level of confidence (Table 1.3).

Section 2 measured the ability of students to correctly describe pathologic attributes of an image when a list of terms was provided. In section 2, the mean score for the control group was -0.22 with a SD of 0.23, and the mean score for the user group was -0.10 with a SD of 0.18 (Table 1.2). The mean difference between users and controls was 0.14 at p-value 0.007 with an effect size of 0.65. Users could be expected to outperform controls between 0.04 and 0.24 points at a 95% level of confidence (Table 1.3). Although these results were statistically significant, the effect size was not clinically relevant. When given a list of terms, the user and control populations performed similarly.

Section 3 measured the ability of students to define a field of conditions that the photos could reasonably represent. In section 3, the mean score for the control group was -0.28 with a SD of 0.2, and the mean score for the user group was -0.17 with a SD of 0.17 (Table 1.2). The mean difference between users and controls was 0.11 at p-value 0.001 with an effect size of 0.59. Users could be expected to outperform controls between 0.02 and 0.20 points at a 95% level of confidence (Table 1.3). As with section 2, these results were statistically significant, but the effect size was not clinically relevant. Thus both user and control groups were able to generate a list of conditions that should be included in the differential diagnosis.

Section 4 measured the ability of students to correctly diagnose the particular condition and form an appropriate problem/plan list once the case history information was provided. In section 4, the mean score for the control group was -13.26 with a SD of 15.05, and the mean score for the user group was 2.07 with a SD of 20.29 (Table 1.2). The mean difference between users and controls was 15.95 at p-value 0.001 with an effect size of 0.81. After using the ODDT students could be expected to outperform controls between 7.18 and 24.72 points at a 95% level of confidence (Table 1.3). As with section 1, these results were statistically significant and clinically relevant.

Section 5 measured the ability of students to retain straight factual knowledge over the testing period. This was assessed by means of 32 true/false questions about various conditions. In section 5, the mean score for the control group was -0.90 with a SD of 10.77, and the mean score for the user group was 2.71 with a SD of 1365 (Table 1.2). The mean difference between users and controls was 4.17 at p-value 0.1.89 with an effect size of 0.81. After using the ODDT students could be expected to outperform controls between -1.98 and 10.33 points at a 95% level of confidence (Table 1.3). The p-values, the large SD relative to the mean, and the low effect size indicate that there was no significant difference between the users and controls when it came down to retaining factual knowledge.

Discussion

The study hypothesis was that using the ODDT improves performance in the area of clinical description, diagnosis and treatment of ocular disease. The ODDT was designed to be engaging and interactive. The interactions were constructed to bring students to the point of making a decision about a slide or case scenario, and reinforced by requiring students to type in their answers.

Sections 1 and 4 demonstrated clinically relevant differences in performance between user and control populations.

Section 1 assessed the ability to correctly describe clinical attributes of a fundus picture without making false observations. Section 4 assessed the ability to arrive at a correct diagnosis and create a suitable problem/plan. In order to be clinically relevant, it is desirable to demonstrate an effect size of 0.8 or higher.[3] The effect size for section 1 was 0.77 (p-val 0.001) and the effect size for section 4 was 0.81 (p-val 0.001). In a study of this nature, there are multiple variables at play and demonstrating high effect sizes is difficult. However, we were very pleased that using the ODDT did result in significant performance differences between the user and control populations in these sections. The ability to correctly describe various ocular pathologies without making descriptive errors is a vitally important clinical skill. Correct observational skills play an important role in making the correct diagnosis. Furthermore, the ability to diagnose conditions and formulate appropriate plans is essential for appropriate patient care.

Sections 2 and 3 did not show clinically relevant differences between user and control groups though the results were statistically significant. Section 2 measured the ability of students to correctly match clinicopathologic terms to a picture, and section 3 measured the ability to form a list of conditions that comprise the differential diagnosis of a particular condition based solely upon the clinical appearance. These results were not surprising. We would expect that students in their fourth year should be able to recognize and apply the correct terminology to characterize pathologic changes to tissue, even though they may not be able to recall the terms as in section 1. Because students were matching terms from a list, there is less likelihood of describing an image incorrectly. With regard to section 3, which measured the ability to generate 2-3 reasonable conditions in the differential diagnosis, the difference between the user and control groups was not clinically relevant. Again, this was not unexpected as we would expect fourth-year clinicians to be able to come up with a list of conditions with or without exposure to the ODDT program.

The results from the analysis of section 5 were unexpected. The ODDT did not improve the factual knowledge retention of students. The measure was a straightforward true/false test. The effect size was 0.33 (p-val 0.189). This was the perhaps the most interesting result of the study. Throughout the diagnostic cases and quizzes, there were numerous questions including matching, fill in the blanks, drag and drop, multiple choice and multiple response. Students were required to answer all the questions at an 80% level in order to complete the program requirements. However, after completing the ODDT curriculum, users did not do much better than the control group in a straightforward true/false factual recognition exercise. As a result of this finding, future modules in the ODDT will emphasize exercises that incorporate observational skills and diagnostic thinking as opposed to exercises that deal with factual knowledge.

Summary

When combining the data for all sections, the mean score for the control group was -9.7 with a SD of 10.4, and the mean score for the user group was 2.1 with a SD of 11.5 (Table 1.2). The mean difference between users and controls was 12.63 at p-value 0.001 with an overall effect size of 1.01. After using the ODDT, students could be expected to outperform controls between 7.5 and 17.7 points at a 95% level of confidence (Table 1.3). Thus using the ODDT improved overall performance by 1.01 SD.

In Table 1.2, there are numerous negative test scores. This is an artifact of the grading rubric. In both the pre-test and the post-test, points were awarded for correct observations and deducted for incorrect observations. The pre-test contained images of conditions, which were less feature-rich than the images used in the post-test. The increase in complexity of the post-test resulted in the potential for more incorrect observations and grade-point deductions. Therefore, it was possible for students to do worse on the post-test than on the pre-test. This proved to be the case.

The standard deviations depicted in Table 1.2 are large relative to the mean. This likely occurred due to wide differences in performance by students in both the user and control populations. One possible reason for disparity in performance may be due to the earnestness of students taking the pre-test and post-test examinations where some students took the exam seriously and others did not. Another possibility is that there is a true disparity with regard to the ability to describe, diagnose and manage ocular disease in fourth-year students. A subanalysis revealed that there was less disparity between the user and control populations in students who were in their fourth clinical rotation than students who were in their first clinical rotation.

Weaknesses and Strengths

The strength of this study is that the ODDT demonstrated a large overall effect size. More importantly, the strongest gains were in the critical tasks of describing clinicopathologic attributes, making the correct diagnosis and formulating an appropriate problem/plan. Effect size is basically the difference in mean values between two or more groups (usually treatment and control), expressed in standard deviation units. The measure of effect size is a useful statistical tool as it allows statistical analysis between two populations that is independent of sample size and the units of measure. Effect sizes may range from negative to positive infinity, but in clinical research effect size rarely exceeds positive 1.0. Cohen assigned relative values to effect sizes as 0.2 = small, 0.5 = medium, 0.8 = large. (3) To achieve an effect size of 0.8 is a significant challenge. Albanese has pointed out that in order to reach a large effect size, some students would be required to move from the bottom quartile to the top 50th percentile or, as another example, some students in the 50th percentile would be required to move the 84th percentile. Albanese comments that over half of the studies in educational and psychological literature would not meet the criteria for a large effect size.[4]

The weaknesses of this study are weaknesses that are inherent in most education research trials. First, it is difficult to isolate a cause and effect relationship between the ODDT user group and the control group. In order to do this, all the ODDT group students would have to use the program in the same

environment and in the same way. This clearly did not happen as some students completed the program over the course of a few days while other students took several weeks to complete the program. Second, it is impossible to control for a myriad of complex and multifactorial variables in real-time environments. Over the nine-month course of the study, some students would have been placed in clinical rotations where there was more ocular disease exposure than in others. Third, some students may have taken the program participation more seriously than others as completing the program was not part of their grade structure. However, it should be noted that only two students assigned to the user group did not complete the study requirements. One of the two incompletes lost the data due an unrelated computer problem.

Comment: Teaching Facts vs. Reasoning

The results of the study indicate that the ODDT was effective in improving the ability of students to correctly describe, diagnose and manage a range of ocular diseases. However, when students were given a true/false test covering factual knowledge, the ODDT was not effective at improving student performance. From an educational perspective this was perhaps the most important discovery of the study. The ODDT presented many quizzes and follow-up questions in the diagnostic cases, both of which were designed to increase factual knowledge. Students were required to answer these fact-based questions correctly in order to complete the ODDT curriculum. The results of this study indicate that students do not retain these factoids very well or for very long. This study raises the age old conundrum: If students do not retain factual knowledge very well or for very long, then should optometric curriculums emphasize teaching and testing factoids? It appears that students may learn and retain the factual knowledge long enough to pass a test, but over time most of that factual knowledge will be forgotten unless it is used frequently.

The question arises as to what is the best use of the face-to-face time instructors have with their students? Should educators plow through disease after disease, presenting all the relevant facts in the traditional fashion of demographics, risk factors, physical exam, pathogenesis, diagnoses and treatment? Surely, it is important that students know this information. Or should educators spend classroom time on training behavioral abilities such as accurately describing the physical findings and making decisions based on the information available? When there is insufficient information, what is the most expedient way to obtain the necessary information that leads to a decision? Do interactive classroom methodologies work better than passive lectures? One study comparing voting machines (clickers) to traditional lecture-based delivery found that voting machines resulted in a significant gain in conceptual learning.[5]

What about testing? At NECO, we have observed that the nature of the test determines how students will prepare for the test. If testing is designed to assess detailed knowledge, students will spend their preparation time memorizing details. On the other hand, if testing emphasizes case interpretation and differential diagnosis, students will spend time analyzing photos and synthesizing paradigms, which helps them to distinguish one condition from another. In doing this, students will learn which facts are necessary for them to know in order to arrive at the correct diagnosis.

What about teaching paradigms? Is one approach superior to the other? Do some students learn better under one model than the other? This study was not designed to compare the ODDT in a head to head fashion with traditional lecture. Rather, this study was designed to demonstrate that students using the ODDT would measurably benefit from doing so. We plan to compare the effectiveness of the ODDT and other CBT applications to traditional lecture in the future.

Conclusion

The ODDT proved to be effective in enhancing performance with regard to its curriculum. Users out-performed controls in their ability to analyze an image, interpret case history and additional examination data, as well as form an appropriate problem/plan list. The ODDT can be used in a variety of settings and locations providing anytime/anywhere access to advanced training in ocular disease. The ODDT has become a permanent and important component to the educational landscape at NECO.

Future Studies

We propose to analyze the effectiveness of a traditional lecture-based learning sequence vs. the effectiveness of an interactive instructional design sequence dealing with ocular disease. Students will have access to the same notes and online lecture materials in both tracks. The traditional lecture track will proceed in the typically expository fashion, while the interactive sequence will use classroom time for the presentation and analysis of cases using a variety of interactive methodologies, including voting machines and team-based learning constructs. In the interactive sequence, the ODDT tool will be used by students outside of class time in order to cover a substantial amount of traditionally taught material. The traditional lecture track will meet twice per week and the interactive sequence will meet once per week. Students will be pre- and post-tested. Performance in clinic and on national board exams will be monitored. We will seek funding to establish new evaluation protocols and analysis.

References

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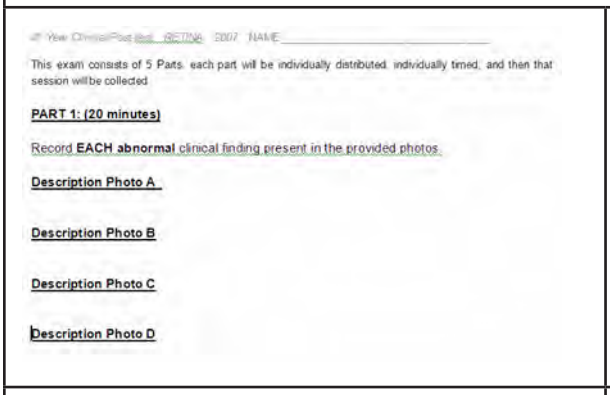
Appendix 1
Example of Pre-test Post-test Format

The Table below shows sample questions from the post-test. The pre-test was essentially similar but the cases and photos were different. The control group and the user group were scored in a blind fashion. The statistical analysis was designed to look for differences between the control group and the user group from baseline. For example, the mean baseline score of the control group may have been 10 points and the mean base line score of the user group may have been 11 points. We expected that the user group as a whole would show a greater delta in score improvement than the control group. In this example, the control group may have improved to 15 points during the test period as they continued their studies and saw more patients. In comparison, the control group may have improved to 20 points. Thus the control group would show a 5-point gain and the user group would show a 9-point gain, with the delta of improvement being 4 points. These figures are for example only. Appendix 2 shows the scoring grid.



4th Year Clinical Post-test RETINA 2007 NAME_____

This exam consists of 5 Parts, each part will be individually distributed, individually timed, and then that session will be collected.

PART 1: (20 minutes)

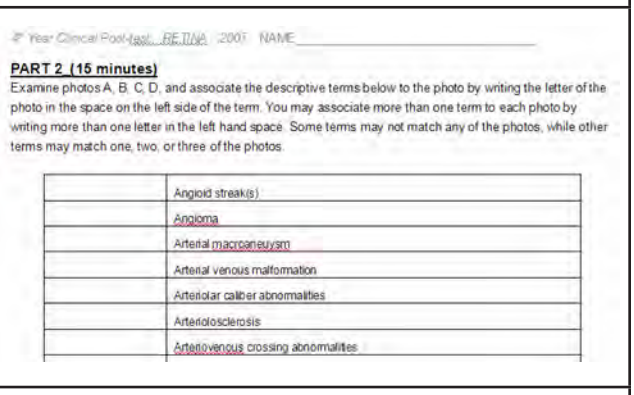
Record **EACH abnormal** clinical finding present in the provided photos.

Description Photo A

Description Photo B

Description Photo C

Description Photo D

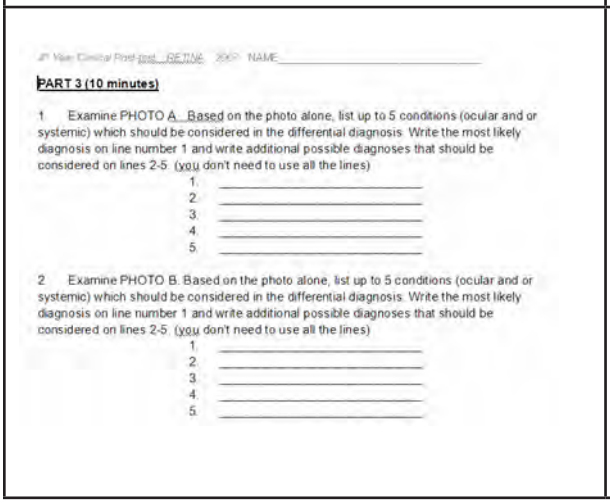


4th Year Clinical Post-test RETINA 2007 NAME_____

PART 2 (15 minutes)

Examine photos A, B, C, D, and associate the descriptive terms below to the photo by writing the letter of the photo in the space on the left side of the term. You may associate more than one term to each photo by writing more than one letter in the left hand space. Some terms may not match any of the photos, while other terms may match one, two, or three of the photos.

	Angioid streak(s)
	Angioma
	Arterial macroaneuysm
	Arterial venous malformation
	Arteriolar caliber abnormalities
	Arteriolosclerosis
	Arteriovenous crossing abnormalities



4th Year Clinical Post-test RETINA 2007 NAME_____

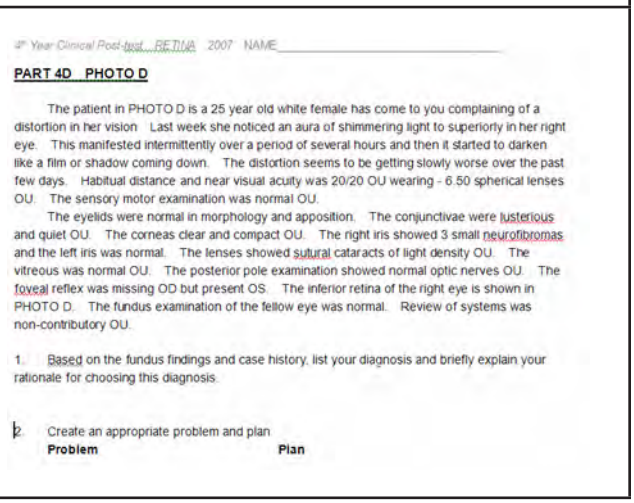
PART 3 (10 minutes)

1. Examine PHOTO A. Based on the photo alone, list up to 5 conditions (ocular and or systemic) which should be considered in the differential diagnosis. Write the most likely diagnosis on line number 1 and write additional possible diagnoses that should be considered on lines 2-5. (you don't need to use all the lines)

1. _____
2. _____
3. _____
4. _____
5. _____

2. Examine PHOTO B. Based on the photo alone, list up to 5 conditions (ocular and or systemic) which should be considered in the differential diagnosis. Write the most likely diagnosis on line number 1 and write additional possible diagnoses that should be considered on lines 2-5. (you don't need to use all the lines)

1. _____
2. _____
3. _____
4. _____
5. _____



4th Year Clinical Post-test RETINA 2007 NAME_____

PART 4D PHOTO D

The patient in PHOTO D is a 25 year old white female has come to you complaining of a distortion in her vision. Last week she noticed an aura of shimmering light to superiorly in her right eye. This manifested intermittently over a period of several hours and then it started to darken like a film or shadow coming down. The distortion seems to be getting slowly worse over the past few days. Habitual distance and near visual acuity was 20/20 OU wearing - 6.50 spherical lenses OU. The sensory motor examination was normal OU.

The eyelids were normal in morphology and apposition. The conjunctivae were lusterious and quiet OU. The corneas clear and compact OU. The right iris showed 3 small neurofibromas and the left iris was normal. The lenses showed sutural cataracts of light density OU. The vitreous was normal OU. The posterior pole examination showed normal optic nerves OU. The foveal reflex was missing OD but present OS. The inferior retina of the right eye is shown in PHOTO D. The fundus examination of the fellow eye was normal. Review of systems was non-contributory OU.

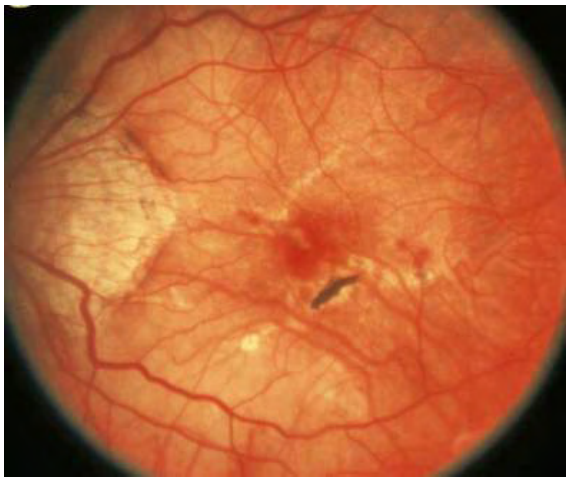
1. Based on the fundus findings and case history, list your diagnosis and briefly explain your rationale for choosing this diagnosis.

2. Create an appropriate problem and plan

Problem **Plan**

Appendix 2
Example of Grading Key Fourth-Year Clinical Post-test 2007

Record each abnormal clinical finding present in the provided photos.



Part 1 PHOTO A 7 Key findings (+1 for each)

KEY FINDINGS

1. Degenerative myopia
2. Diffuse chorioretinal atrophy
3. Lacquer cracks
4. Macula heme
5. PPA
6. RPE hypertrophy and mottling
7. tesselated fundus

Alternate descriptions given by students that were accepted

Albino fundus +1

Area of atrophy near the optic nerve head +1/2

Choroidal scar +1

CNVM +1/2

Fuch spot +1

High myopic retina +1.

Intraretinal hem+1

Macula scar +1

Myopic crescent +1

Subretinal Heme +1

Venous tortuosity +1/2 dilated veins+1/2

Description with no points no deductions

Staphyloma,

Drusen

Hypoperfused retina,

Macula degeneration,

Macula edema

Macula thickening

One point deduction for description given which were inaccurate

-1 angoid streaks

-1 amelanotic growth

-1 artery occlusion

-1 blurred disc margins

-1 cherry red spot

-1 coloboma

-1CSME

-1CWS

-1 exudate

-1 flame

-1 diffuse exudates

-1 feeder vessel

-1indistinct disc margins

-1 NVE--1 NVD

-1 ONH edema

-1 papilledema

-1 Paton's folds

-1/2Peripapillary swelling

-1 preretinal heme

-1 retinal ischemia

-1 retinal tear

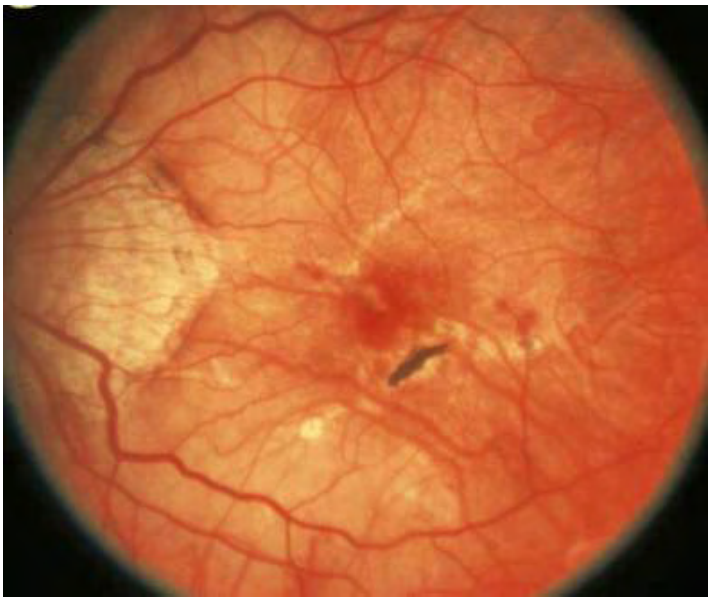
-1 retinoschisis

-1 silver wiring

-1 vitreous hemorrhage

Appendix 2 (continued)
Example of Grading Key Fourth-Year Clinical Post-test 2007

PART 4A PHOTO A



A 60-year-old white male presents as shown in PHOTO A. The patient has noticed blurred vision in the left eye, which started about 4 days ago. The patient was otherwise asymptomatic. Entering DVA was OD 20/30 and OS 20/40 and NVA was OD J2 and OS J3 with a habitual correction of -8.50 spheres OU and +2.00 add. OU. No improvement on pinhole testing. Refraction showed OD -9.00 OD and – 8.75= 75 x 90 OS and =2.25 add OU, yielding DVA OD 20/20, OS 20/40 and NVA OD 20/20, OS 20/40. One year ago the patient saw 20/20 at distance in each eye with the habitual prescription of -8.50 OU. The pupillary responses were normal. The eyelids showed mild meibomian gland dysfunction with tear frothing along the lacrimal lake OU. Both corneas showed prominent Hudson-Stahli lines and Type I limbal girdles. Prominent central guttata were present OU. The anterior chambers were normally formed. The vitreous and aqueous humors were clear and acellular OU. The lenses were clear OU. 78D examination of the posterior pole of the right eye revealed similar presentation as seen in PHOTO A of the left eye. Amsler grid testing was normal OD, but showed metamorphopsia OS. 20D BIO examination of the right eye revealed 2 areas of lattice degeneration about ½ by 2 Disc Diameters without breaks in the superior temporal and inferotemporal quadrants respectively. The left eye revealed a single area of lattice about ½ by Disc Diameters with breaks visible and I DD of surrounding edema on the ends of the lesion, which was located in the superior temporal periphery. IOP was OD = 15, OS = 15 mm Hg at 9:00 AM.

Review of systems indicates early onset hypertension beginning at age 50 for which the patient takes HCTZ once daily

Appendix 2 (continued)
Example of Grading Key Fourth-Year Clinical Post-test 2007

1. Based on the fundus findings and case history, list your diagnosis and briefly explain your rationale for choosing this diagnosis.

Grading the diagnosis is worth +5 in this section and 3 points for rationale max for this section is +8 even if more rationals are correct

Lacquer cracks OS or degenerative myopia 5 points

High myope with white linear marks in the macula region+3
High myopia +2
Myopic degeneration +3
Wet AMD+1
Metamorphosia +1
-8.50 myope+1
Lattice degeneration+1
Parapapillary atrophy +1

2. Create an appropriate problem and plan

Problem

(2pts) 1. Lacquer cracks OS

(1pts) 2. Several Areas of Lattice Degeneration
One with breaks visible and surrounding edema

(1pts) 3. Meibomitis

(1pts) 4. Prominent guttata OU

(1pts) Fuch"s

Plan

(+2pts) 1. refer for FAA and or OCT
if they just write refer +1
if they say refer to then give +2

(1pts) 2. Refer for possible laser treatment

3. Warm compresses and lid scrubs

4. Monitor yearly for progression to

Total 8
Just myopic degeneration in problem +1
Just CNVM +1
If they put send to PCP for general elastic tissue workup +1 total for problem and plan
If they put polycarbonate lenses +1
Note on number 3 and 4 they must have both the problem and the plan correct to get +1