

Klinische Monatsblätter für Augenheilkunde

November 2006 · Page S1 – S19 · Volume 223 · Supplement 5

11 · 2006

S3	I. Preamble
S5	II. Fundamentals and Principles of Ophthalmology
S6	III. Cornea and External Diseases
S7	IV. Lens and Cataract
S7	V. Neuro-Ophthalmology
S8	VI. Vitreoretinal Diseases
S9	VII. Glaucoma
S10	VIII. Pediatric Ophthalmology and Strabismus
S11	IX. Diseases of Eyelid, Lacrimal System, and Orbit
S12	X. Ocular Manifestations of Systemic Diseases
S13	XI. Intraocular Tumors
S14	XII. Refraction and Contact Lens
S14	XIII. Refractive Surgery
S15	XIV. References
S16	XV. Ophthalmic Images by Anatomic Location and Diagnosis

Klinische Monatsblätter für Augenheilkunde

November 2006 · Page S1 – S19 · Volume 223 · Supplement 5

11 · 2006

Preface

In 1999 and 2000, the International Council of Ophthalmology and the Academia Ophthalmologica Internationalis developed an International Ophthalmology Strategic Plan to preserve and restore vision – Vision for the Future.

This strategic plan involved a multi pronged approach to reduce visual impairment and blindness worldwide, and the following actions have been completed or are underway to make this plan a reality:

- ▶ IFOS/ICO fellowships have been established under the leadership of Professor Balder Gloor to provide overseas educational opportunities for junior ophthalmic faculty in ophthalmology departments in developing countries.
- ▶ The International Assessment for Ophthalmologists in both clinical and basic sciences has been successfully implemented by Professor Peter Watson.
- ▶ Eye care guidelines to develop evidence-based eye care delivery, are being developed under the leadership of Professor Richard Abbott.
- ▶ Advocacy for preservation and restoration of vision to increase public awareness of blindness prevention is being headed by Professor Hugh Taylor.
- ▶ Research in ophthalmology and vision, for development of new and improved therapies for blinding diseases, is being led by Professor Alfred Sommer.

The ICO Strategic Planning Group also decided that ophthalmic education is the cornerstone to improve eye care globally. As part of this Strategic Plan, four International Task Forces were established to develop curricula for training of the ophthalmic specialist, para-ophthalmic personnel, medical students, and for continuing medical education.

After years of hard work by multiple international panels, the four curricula are being presented for publication in this issue of Klinischen Monatsblätter für Augenheilkunde as supplements.

The curricula are presented, not as mandatory standards of training or practice, but as an educational tool and consensus example to stimulate multi-levels of training including basic, standard, and advanced programs. The International Council of Ophthalmology realizes the wide variability of educational standards, patterns and prevalence of diseases, and social structures for provision of eye care in geographic regions, and therefore encourages continuous modification of these curricula according to the needs of different global communities.

Traditionally, ophthalmology residency training runs on an “Apprenticeship System” where the teaching contents and format for trainees frequently depend on the whims of the trainers. In recent decades, there is a general movement to shift the apprenticeship system of education to a curriculum-based system of

education in which goals, expectation, knowledge base, competencies and technical training are carefully defined. The four international curricula are prepared with this general direction in mind.

The panels, which drafted these curricula, understand the importance of accessibility of the educational materials and availability of mentorship. The International Task Forces encourage the donation of good teaching material to be included in these curricula and to be available for teachers and students worldwide. The ICO also proposes the twinning of training programs of industrialized and developing countries to encourage the exchange of mentors. It is recognized that competency in the practice of medicine depends on factors other than medical knowledge as outlined in these curricula. Inter-personal communication skills, professionalism, system-based factors, surgical skills, a solid ethical foundation, and others contribute substantially to the expertise and competence of eye care specialists. These curricula only provide a framework to initiate the training process.

Efficiency of eye care in the modern practice of ophthalmology depends on teamwork, consisting of ophthalmic physician specialists, ophthalmic nurses, orthoptists, optometrists, clinic managers, and others. The balance and composition of an eye care team is critical for maximum productivity of the care provided. So in these curricula, training of the eye care team is being covered.

The rapid development of medical technology in the 21st Century has resulted in greater discrepancies in the levels of medical care in various geographic locations of the world. However, the world does not work unless the world works together. These international curricula of ophthalmic education are attempts to encourage different players in the international ophthalmic educational arena to work together to develop a forward movement for improved eye care worldwide.

The International Council of Ophthalmology and the International Task Forces on Ophthalmic Education would like to thank the editors, Professors Gerhard K. Lang and Gabriele E. Lang, Project Manager, Katrin Stauffer of Klinischen Monatsblätter für Augenheilkunde, for their gracious assistance in publishing these curricula.

Mark O.M. Tso, MD, D. Sc.

Editor of International Curricula on Ophthalmic Education

Education Director

International Council of Ophthalmology

G.O.H. Naumann, MD

Former President (1998 – 2006)

International Council of Ophthalmology

Bruce E. Spivey, MD

President

International Council of Ophthalmology

Principles and Guidelines of a Curriculum for Ophthalmic Education of Medical Students

Presented by International Task Force on Ophthalmic Education of Medical Students – On Behalf of The International Council of Ophthalmology (ICO)

Chairman of Task Force

Richard K. Parrish II, MD (USA)

Editor and Education Director, ICO

Mark O.M. Tso, MD (USA) (China)

Bibliography

DOI 10.1055/s-2006-951844
Klin Monatsbl Augenheilkd 2006; 223, Suppl 5: S3 – S19
© Georg Thieme Verlag KG
Stuttgart · New York ·
ISSN 1431-634X

Corresponding Author

Mark O.M. Tso, MD

Wilmer Eye Institute, Johns Hopkins University, 457 Woods Building, 600 North Wolfe Street, Baltimore, MD 21287-9142, USA; and Peking University Eye Center, The Third Teaching Hospital, Peking University, 49 North Garden Road, Haidian District, Beijing 100083, People's Republic of China, Fax: 410-614-1114 (USA); Fax: 8610-8208-9951 (China)

Major Contributors:

Richard K. Parrish II, MD (USA)
Adenike Aboise, MD (Nigeria)
Geoffrey Broocker, MD (USA)
Miguel N. Burnier, MD (Canada)
Akef El-Maghraby, MD (Saudi Arabia)
Daniel Eyta'ale, MD (Switzerland)
Gerhard K. Lang, MD (Germany)
Zi-Liang Li, MD (China)
Susan Lightman, MD (UK)
Kathleen A. McClellan, MD (Australia)
Casey Mickler, MD (USA)
Marilyn T. Miller, MD (USA)
Robert B. Nussenblatt, MD (USA)
Yasuo Tano, MD (Japan)

Executive Committee of ICO [1998 – 2006]:

Gottfried O.H. Naumann, MD, President (Germany)
Mark O.M. Tso, MD, Vice-President (USA) (China)
Bruce E. Spivey, MD, Secretary General (USA)
Balder Gloor, MD, Treasurer (Switzerland)

I. Preamble

In the International Ophthalmology Strategic Plan to Preserve and Restore Vision (1999), an International Task Force on Ophthalmic Medical Student Education was established. The leadership of the International Council of Ophthalmology (ICO) agrees that ophthalmic education of medical students should include the basic knowledge and skills to provide appropriate levels of primary eye care, and medical students should learn the indications and need for referral to ophthalmologists for management of specialty cases. Evidence-based ophthalmic curriculum for medical students should be incorporated as core curriculum for all medical schools. It is recognized that in different geographic regions of the world, medical graduates may be required to provide primary eye care, while others may have

easy access to referral of ophthalmic specialists. Ophthalmic manifestations of systemic diseases are common, and an understanding of these eye manifestations is a necessary part of the comprehensive education for modern physicians.

History of Task Force on Ophthalmic Education of Medical Students

The International Council of Ophthalmology passed a resolution to call on all medical schools worldwide to establish a curriculum for ophthalmic education of medical students as part of their core curriculum for medical education, rather than as an elective in the course of medical education. Dr. Yasuo Tano (Japan) and Dr. Gerhard K. Lang (Germany) were asked to Co-Chair the Task Force.

Acknowledgement: ICO gratefully acknowledges the editorial efforts of Jenni Anderson and Lenalee Fulton in coordinating and assembling these curricula.

Publication of this curriculum was partially supported by a contribution from the International Council of Ophthalmology Foundation

Manuscript Editor: Tina-Marie Gauthier

The Task Force took initiatives to begin developing a curriculum, and noted that:

1. In the 21st Century, eye care has become increasingly important in the general practice of medicine.
2. Vision is one of the vital factors influencing quality of life.
3. As ophthalmic manifestations of systemic diseases are commonly associated with medical, neurological, and metabolic diseases, primary eye care (including recognizing eye diseases) should be the responsibility of family physicians.
4. A solid education in ophthalmology should be part of the comprehensive education of the modern physician. The Task Force recommended that the educational programs of all medical students include a basic understanding of eye diseases and eye manifestations of systemic diseases. Ideally, the family physician should recognize the eye diseases which would require a referral to an eye care specialist.
5. Historically, teaching methods of ophthalmology for medical students have consisted of: 1) traditional didactic lectures and clinical demonstrations; 2) illustrative case studies to highlight particular eye diseases; and 3) evidence-based medical teaching, pairing ophthalmic teaching with neuroscience, neurology, endocrinology, pediatrics, and other relevant subjects. The Task Force emphasizes the importance of clinical exposure to patients. Patient contact and bedside teaching in ophthalmology are critical in providing clinical experience.
6. Ophthalmology is mostly a surgical specialty, so medical students should be given an opportunity to observe procedures in the operating room. By allowing students to be exposed to the surgical procedures, they will acquire a more realistic understanding of ophthalmic practice.
7. The time allotment for teaching students in ophthalmology is important. It is recognized that different medical subspecialties compete vigorously for time in the medical education curriculum. However, an adequate period of time must also be allotted for learning eye care.

In January 2002, Dr. Richard K. Parrish II, took over the Chairmanship of the International Task Force and started working on a detailed curriculum for ophthalmic education of medical students. The Task Force considered the importance of local diseases in different countries, especially in areas where eye diseases such as onchocerciasis or cataract are endemic. It is strongly believed that medical students in those regions should have a more in-depth understanding of these conditions. The final report consists not only of subjects in the curricula, but also covers sources of illustrative materials for use in teaching.

Under the leadership of Dr. Parrish, a series of principles were determined and guided the committee in the preparation of this curriculum.

1. The reduction in time allotted for ophthalmic education in medical school threatens to diminish the clinical skills of graduating physicians throughout the world. This will adversely affect the quality of eye care knowledge worldwide.
2. An ophthalmic cognitive and clinical skill set should be defined for international medical educators.
3. Basic ophthalmic knowledge and clinical skills should be recognized internationally and included as part of the medical student's general curriculum.
4. Recommendations of the Task Force should reflect the consensus of a broad-based international ophthalmic educational community.

5. The Task Force should define minimum standards for medical student education which are not intended to replace existing curricula, such as Blueprint 2001: Training of Doctors in the Netherlands, or the Swiss Catalogue of Learning Goals in Ophthalmology.
6. Teaching materials, including clinical photographs, selected readings from existing textbooks, and publications should be made available through the ICO website for international medical students who do not have ready access to printed material.

The Task Force Chairman queried members of the International Federation of Ophthalmological Societies in January and April 2003 to determine the minimum ophthalmic knowledge and clinical skills that graduating medical students should demonstrate. It was determined that all medical students should demonstrate competency in these areas:

1. Measurement of near visual acuity with and without correction.
 2. Determination of visual fields by confrontation technique.
 3. Assessment of extraocular motility in the six cardinal positions of gaze and primary position.
 4. Measurement and interpretation of pupillary size and reaction to light.
 5. Penlight examination of the anterior segment, including upper lid eversion.
 6. Examination of the optic nerve and posterior pole with direct ophthalmoscopy.
 7. Removal of superficial corneal or conjunctival foreign body.
- With these skills, the graduating medical student should be able to make the following diagnoses and initiate an appropriate treatment or referral plan for the following conditions: 1) conjunctivitis; 2) cataract; 3) corneal ulcer; 4) corneal foreign body; 5) macular degeneration; 6) diabetic retinopathy; 7) hypertensive retinopathy; 8) glaucoma; 9) uncorrected refractive error; 10) ocular trauma; 11) papilledema; 12) hemianopic and bi-temporal visual field defects; 13) acute onset of cranial nerve palsies III, IV, VI; 14) acute onset strabismus; 15) leukocoria.

The medical student curriculum designed by the ICO Task Force is divided into 12 parts. The first section, Fundamentals and Principles of Ophthalmology, outlines essential skills and serves as a basis for understanding the information provided in the 11 subspecialty sections. Just as other widely circulated consensus documents reflect educational priorities, such as Blueprint 2001: Training of Doctors in The Netherlands (see References: Additional Source of Teaching Material), the curriculum of the Task Force is intended to complement, not replace, these existing standards. The Task Force members understand that large regional variations in disease prevalence preclude the development of an inclusive curriculum for all medical students. This document is intended to serve as a resource that will provide access to a wide range of important educational topics.

Educational Priorities

- * **Basic Level:** Information designated with a single asterisk (*) is necessary in the education of medical students worldwide.
- ** **Standard Level:** Information designated with two asterisks (**) reflects a higher level of ophthalmic understanding. Although not basic, many medical schools may already include this material in their curriculum. While important to ophthalmic care, the Task Force does not regard the cognitive or

skill set designated under Standard Level as falling within the basic curriculum of most international medical students. This material may form the basis for an ophthalmology elective in medical school.

*** **Advanced Level:** Information designated with three asterisks (***) marks areas of advanced cognitive and clinical skills that are more appropriate for students who seek further training in ophthalmology. While important to ophthalmic care, the Task Force does not regard the cognitive or skill set designated as Advanced Level as falling within the basic curriculum of most international medical students. This material may form the basis for an ophthalmology elective in medical school.

Hours in Curriculum

The Task Force strongly recommends that all medical schools include ophthalmology as a part of the essential curriculum and not exclusively as an elective. The increasing age of the world population, high prevalence of common problems such as eye injury and red eye, and importance of vision in the information age support the need for the expansion of ophthalmic education. To achieve this goal, the exact allotment of curriculum hours will depend on existing specific medical school infrastructure and general curriculum. The Task Force strongly recommends that sufficient time in the classroom and clinical setting be dedicated to mastering the learning objectives and clinical skills labeled as "Basic." The Task Force also strongly recommends that ophthalmic education should not be limited to the formal classroom setting, but also takes place in the clinic and operating room. Each student should be given an opportunity to observe common ophthalmic procedures, such as treatment of chalazion, removal of corneal foreign body, or cataract operation, and to examine the anterior segment with slit lamp biomicroscopy. The Task Force estimates that the total educational commitment throughout medical school will require approximately 40–60 hours (or 5 to 8 days) exposure.

Specific Teaching Methods

Three teaching methods have traditionally been described to achieve ophthalmic educational goals: didactic lectures and clinical demonstration; illustrative case method study; and evidence-based medicine teaching (where ophthalmic education is paired with neuroscience, neurology, endocrinology, and geriatric medicine). The Task Force recommends that international medical schools employ all methods to achieve these broad educational goals. The Task Force judges these teaching techniques to be complimentary and not competitive in nature. As the body of new information acquired through randomized clinical trials expands rapidly, the Task Force believes that the importance of evidence-based medicine will continue to grow.

Resources

Specific educational information is available through several existing publications of the American Academy of Ophthalmology and are referenced and identified to facilitate access.

Complete lectures on many important topics have been prepared by Professor Susan Lightman, Department of Clinical Ophthalmology at Moorfields Hospital, London, UK, and have been used as a part of the Curriculum for Undergraduate Medical Educa-

tion. These self-contained educational units are presented in their entirety and may be accessed as identified.

To facilitate access, references (ref.) to images, figures, and charts from publications of the American Academy of Ophthalmology and others are listed within the curriculum. This may be of particular value for those students who do not have ready access to printed reference texts. The Task Force recommends that this information be made available without charge to all students and teachers for educational purposes. Additionally, the Task Force recommends that the Basic and Clinical Science Course manual teaching materials provided by the American Academy of Ophthalmology and the Undergraduate Medical Lecture Series provided by Professor Susan Lightman, Department of Clinical Ophthalmology, Moorfields Eye Hospital, London, UK, shall be made available to teachers and students all over the world through the ICO website: <http://www.icoph.org/>.

Curriculum for Ophthalmic Education of Medical Students

II. Fundamentals and Principles of Ophthalmology



Educational Goal: Medical students should recognize external and internal ocular structures of the normal human eye and know how to perform a basic eye examination.

Students should:

- ▶ Describe normal ocular anatomy.* (REF. 2E Slide 58, 59;)
(REF. 22 Fig. G02)
 - ▶ Obtain an accurate and complete ocular history.*
(REF. 2B Slide 14)
 - ▶ Measure and record near visual acuity in an adult with near correction and understand principles of distance acuity measurement in adults and children.*
 - ▶ Assess pupillary reflexes.*
 - ▶ Evaluate ocular motility.* (REF. 4 Table 1.2 and Figure 6.10)
 - ▶ Use the direct ophthalmoscope for assessment of red reflex, the optic nerve, and posterior fundus examination.* (REF. 22 Fig. I03)
 - ▶ Dilate the pupils.*
 - ▶ Perform and evaluate visual fields by confrontation.*
- A. Ocular Anatomy.*
Students should be able to define each of these structures and describe their function. (REF. 4 Fig. 1.1, 1.2)
1. Eyelids.*
 2. Sclera.*
 3. Limbus.*
 4. Iris.* (REF. 2E Slide 58)
 5. Pupil.*
 6. Conjunctiva.*
 7. Cornea.* (REF. 2E Slide 58, 59)
 8. Extraocular muscles.*
 9. Anterior chamber.* (REF. 2E Slide 58)
 10. Lens.* (REF. 2E Slide 58)
 11. Ciliary body.* (REF. 2E Slide 58)
 12. Posterior chamber.*
 13. Vitreous cavity.*
 14. Retina.* (REF. 4 Fig. 1.15)
 15. Macula.*

16. Choroid.*
 17. Optic nerve.* (REF. 24 Slide 3)
- B. Visual Acuity.*
1. Students should understand the purpose of measuring near visual acuity with and without correction and testing each eye individually.* (REF. 2E Slide 7) (REF. 4 Fig. 1.8)
 2. Students should understand the concept of distance visual acuity testing with and without correction and with a pinhole. Students are not expected to perform refraction.* (REF. 4 Table 1.1)
- C. External Inspection.* (REF. 22 Fig. G36, G40, G44)
 Students should understand the external ocular anatomy, evaluate the position of the lids, and inspect the conjunctiva, sclera, cornea, and iris with a penlight.
- D. Pupillary Reaction Testing.* (REF. 24 Slide 11)
 Students should measure the pupillary size and assess the direct and consensual pupillary reaction.
- E. Ocular Motility Testing.*
 Students should understand the importance of assessing ocular motility in the six cardinal positions of gaze and ocular alignment in primary position.
- F. Direct Ophthalmoscopy.*
 Students should understand the basic function of an ophthalmoscope and should know how to adjust focus. Students should know the importance of the relationship between which examiner's hand is used to examine the patient's right or left eye.
- G. Pupillary Dilatation.* (REF. 22 Fig. J05)
 Students should understand how to pharmacologically dilate pupils for examination of the ocular fundus. Students should understand the difference between retinal arterioles and retinal venules, the normal appearance of the optic nerve head, retinal pigment epithelium, and foveal reflex. Student should also recognize the normal uniform red-orange background retinal color due to retinal pigment epithelium and choroid.
- H. Intraocular Pressure Measurement.* (REF. 22 Fig. C29, C30)
 Students should understand the concept of assessing intraocular pressure, but are not expected to measure intraocular pressure with a tonometer.
- I. Anterior Chamber Depth Assessment.* (REF. 4 Fig. 1.10)
 Students should understand how to assess anterior chamber depth with a penlight held at an oblique angle to the optical axis.
- J. Confrontation Field Testing.*
 Students should understand the principle and technique of determining the peripheral visual field by the finger counting confrontation technique.
- K. Upper Lid Eversion.* (REF. 4 Fig. 1.9)
 Students should know how to evert the upper lid and examine for the presence of foreign bodies.
- L. Fluorescein Staining of the Cornea.* (REF. 2E Slide 61 – 63)
 Students should know how to apply topical fluorescein and interpret staining of the cornea for detection of a corneal epithelial defect. (REF. 4 Fig. 1.12 and 1.13)
- M. Indications for Referral.*
 Students should know when to refer patients to an ophthalmologist for evaluation of suddenly reduced visual acuity, abnormal fundus appearance, and other abnormal findings associated with serious ocular or systemic disease.

Clinical Competencies

Students should:

- ▶ Understand basic ocular anatomy.*
- ▶ Measure near visual acuity.*
- ▶ Test for direct, consensual, and afferent pupillary reactions.*
- ▶ Understand the rationale and interpretation of testing the red reflex.*
- ▶ Understand the importance of the dilated fundus examination.*
- ▶ Understand and perform direct ophthalmoscopy.*
- ▶ Understand normal fundus appearance of the optic disc, macula, and major vessels.
- ▶ Understand important causes of reduced vision, abnormal fundus appearance, and abnormal findings that require referral of the patient to an ophthalmologist for evaluation.*

III. Cornea and External Diseases



Educational goal: Students should understand anterior segment anatomy of the human eye and know the signs and symptoms of common causes of red eye. Students should also know which corneal and external related conditions require immediate referral to an ophthalmologist.

- A. Anatomy. (REF. 2E Slide 59)
1. Lids.* (REF. 2E Slide 10, 12)
 - a. Glands of Zeis and Moll.*
 - b. Lashes.*
 - c. Meibomian glands.*
 - d. Lacrimal gland.*
 2. Conjunctiva.* (REF. 2E Slide 28)
 - a. Bulbar.*
 - b. Palpebral.*
 3. Regional lymph nodes.**
 - a. Preauricular.**
 - b. Submandibular.**
 4. Cornea.*
 - a. Tear film.*
 - b. Epithelium.*
 - c. Stroma.*
 - d. Endothelium.*
 5. Lacrimal system.*
 - a. Punctum – upper and lower.*
 - b. Lacrimal sac.*
- B. Red Eye.* (REF. 2E Slides 1 – 6)
1. Acute angle closure glaucoma.* (REF. 2E. Slide 83 – 87) (REF. 22 Fig. C01, C05, C09)
 2. Iritis or iridocyclitis.* (REF. 2E. Slide 81, 82)
 3. Herpes simplex keratitis.* (REF. 2E. Slide 74,75) (REF. 3 Case 13, Ocular Herpes Simplex. p. 26) (REF. 22 Fig. B06)
 4. Bacterial keratitis.* (REF. 2E. Slide. 76) (REF. 2C Slide 56) (REF. 22 FIG. B08)
 5. Conjunctivitis.* (REF. 2E Slide 29 – 31, 45)
 - a. Bacterial.* (REF. 2E Slide 32 – 34)
 - b. Viral.* (REF. 2E Slide 35, 36, 74) (REF. 3 Case 2, Viral keratoconjunctivitis. p. 4) (REF. 22 Fig. B01)
 - c. Allergic.* (REF. 2E Slide 37, 38) (REF. 2C Slide 53) (REF. 4 FIG 4.17) (REF. 22 FIG. B51)
 - d. Neonatal.* (REF. 2E Slide 39 – 42, 44 – 46)
 - e. Neonatal gonococcal.* (REF. 2E Slide 43)
 6. Episcleritis.** (REF. 2F Slide 47) (REF. 21 Fig. B50)
 7. Scleritis.** (REF. 2F Slide 48, 49, 50)

8. Adnexal disease.*
 - a. Blepharitis.* (REF. 2E Slide 15 – 18) (REF. 3 Case 18, Blepharitis, p.36) (REF. 21 Fig. B49)
 - b. Thyroid eye disease.* (REF. 2F Slide 64 – 74) (REF. 22 Fig. E19 – E21)
 - c. Dacryocystitis.* (REF. 2E Slide 25)
 - d. Hordeolum.* (REF. 2E Slide 11) (REF. 4 FIG 4.18, 4.19) (REF. 3 Case 26, Hordeolum, p.32)
 - e. Chalazion.* (REF. 2E Slide 13) (REF. 22 Fig. B43, B44)
 9. Subconjunctival hemorrhage versus hyphema.* (REF. 2E Slide 47) (REF. 4 FIG 5.10) (REF. 22 Fig. B38, L11)
 10. Pterygium.* (REF. 2E Slide 55) (REF. 22 Fig. B29, B30)
 11. Keratoconjunctivitis sicca.* (REF. 2E Slide 48 – 50) (REF. 22 Fig. B05)
 12. Corneal abrasions and foreign body.* (REF. 2E Slide 62, 63) (REF. 2C Slide 39 – 42) (REF. 4 Fig. 5.7, 5.8) (REF. 22 Fig. L06)
 13. Secondary to abnormal lid function.**
 - a. Bell's palsy.**
 - b. Thyroid ophthalmopathy.** (REF. 2F Slide 64 – 74) (REF. 22 Fig. E19 – E21)
 14. Hyphema.** (REF. 2E Slide 80) (REF. 3 Case 16, Traumatic Hyphema, p.32) (REF. 22 Fig. L11)
 15. Chemical injury.** (REF. 2E Slide 69, 70,71) (REF. 3 Case 24, Alkali Burn, p.48) (REF. 22 Fig. B14, B15)
- C. Symptoms associated with red eye.*
1. Blurred or decreased central visual acuity.*
 2. Photophobia.*
 3. Colored halos.* (REF. 2E Slide 84)
 4. Discharge.*
 5. Itching.*
- D. Steps to differentiate red eye and how to interpret findings.* (REF. 5, Table 4.1, 4.2)
1. Measure central acuity at near.* (understand importance of reduced visual acuity)
 2. Determine location of redness.*
 - a. Subconjunctival hemorrhage.* (REF. 22 Fig. B38)
 - b. Conjunctival hyperemia (epibulbar, palpebral or both).*
 - c. Ciliary flush associated with corneal inflammation, iritis, and acute glaucoma.* (REF. 4 Fig. 4.2)
 3. Assess discharge and characterize.*
 - a. Profuse or scant.*
 - b. Purulent, mucopurulent, or serous.*
 4. Assess for corneal opacity associated with edema, inflammation, and ulcer.* (REF. 3)
 5. Examine for corneal epithelial defect with fluorescein.*
 6. Estimate anterior chamber depth associated with acute angle closure glaucoma.* (REF. 4 Fig. 1 – 10)
 7. Examine pupils and understand the importance of pupillary size with iritis (miotic) and acute angle closure glaucoma (mid-dilated).* (REF. 5 Table 4.1)
 8. Measure intraocular pressure if elevation suspected.***
 9. Assess and detect:
 - a. Proptosis associated with orbital mass.*
 - b. Lid malfunction.*
 - c. Limitation of eye movement.*
 - d. Preauricular lymph node enlargement.*

Clinical Competencies

Students should:

- ▶ Measure central acuity with near card.*
- ▶ Assess corneal clarity with a penlight.*

- ▶ Assess anterior chamber depth and narrowness of angle with a penlight.*
- ▶ Assess pupil size, shape, regularity, and reactivity.*
- ▶ Determine if redness is associated with subconjunctival hemorrhage, ciliary flush, or conjunctival hyperemia.*
- ▶ Assess conjunctival discharge.*
- ▶ Determine if proptosis is present.*
- ▶ Assess ocular motility.*
- ▶ Understand findings that are associated with serious ocular conditions that require immediate ophthalmic care.*

IV. Lens and Cataract



Educational goal: Students should recognize the symptoms and ophthalmic signs of cataract as a cause of decreased central visual acuity. They should understand the general principles of cataract surgery and correction of aphakia with intraocular lenses, contact lenses, or aphakic spectacles.

- A. Anatomy of lens.*
1. Intraocular location of lens behind the iris plane.*
 2. Optical clarity of normal lens.*
 3. Suspension of normal lens in retroiridic position by zonules.*
- B. Symptoms attributable to cataract.* (REF. 2B. Slide 10, 51) (REF. 22 Fig. A01 – A06)
1. Slowly progressive blurring of vision.*
 2. Painless progressive loss of vision.*
- C. Examination of the lens by direct ophthalmoscopy.*
1. Evaluation of red reflex.* (REF. 4 Fig. 3.9 – 3.11)
- D. Abnormal lens features by direct ophthalmoscopy.*
1. General.*
 - a. Loss of normal red reflex.* (REF. 4 Fig. 3.9 – 3.11)
 - b. Dark spots in red reflex.* (REF. 2B Slide 50)
 - c. Abnormal color of red reflex.*
 2. Lens abnormalities found in important systemic diseases.*
 - a. Marfan's syndrome – spontaneous dislocation of lens.* (REF. 15 Fig. 4 – 15A, B) (REF. 22 Fig. H38)
 3. Lens abnormalities found in important ocular diseases.**
 - a. Cataract (clouding or opacification of lens).** (REF. 22 Fig. A07, A10)
 - b. Implanted artificial intraocular lens.** (REF. 22 Fig. A24, A26, A27)
- E. Treatment of cataract.** (REF. 3 Case 6, Cataract, p.12)
1. Surgical removal of lens (cataract extraction).*** (REF. 2B Slide 52) (REF. 22 Fig. A19 – A23)
 2. Implantation of artificial lens in eye.*** (REF. 2B Slide 54)
- F. When to refer patient to an ophthalmologist.**
1. Examination reveals abnormal red reflex, lens clouding, or opacity.**
 2. Patient reports progressive visual loss or blurring.**

Clinical Competencies

Students should:

- ▶ Describe presbyopia.**
 - ▶ definition and symptoms.**
- ▶ Diagnose cataract.*
 - ▶ definition and symptoms.*
 - ▶ red reflex.*
 - ▶ slit lamp findings.***
- ▶ Understand importance of lens dislocation in association with systemic conditions, such as Marfan's syndrome and homocystinuria.***

- ▶ Describe management of cataract.***
 - ▶ surgery.***
 - ▶ intraocular lens.***

V. Neuro-Ophthalmology

Educational goal: Students should understand the relationship of the eye and visual system within the context of the central nervous system. Students should also know how to test pupillary reactions and how to assess peripheral visual fields, and should understand conditions which require immediate ophthalmic evaluation, such as sudden vision loss, papilledema, and anterior ischemic optic neuropathy with giant cell arteritis in the elderly patient, III nerve palsy with pupillary involvement, IV and VI nerve palsies.

- A. Anatomy.*
 1. Bony anatomy.**
 2. Vascular anatomy.**
 3. Afferent visual pathways.* (REF. 4 Fig. 7.12)
 4. Ocular motor pathways.*
 5. Facial motor and sensory anatomy.*
 - a. Trigeminal nerve.*
 - b. Facial nerve.*
 6. Ocular autonomic pathways.*
 - a. Sympathetic pathways. (REF. 24 Slide 13 – 15) (REF. 4 Fig. 7.4)
 - b. Parasympathetic pathways.*
 7. Pupillary pathways.* (REF. 4 Fig. 7.1)
- B. Neuroimaging.**
 1. Glossary.**
 2. History.**
 3. Basics of magnetic resonance imaging (MRI) and computerized tomography (CT) scanning.**
 4. Fundamental concepts in localization.**
- C. How to examine the patient.*
 1. Visual acuity testing.*
 2. Visual field testing – confrontation.*
 3. Extraocular motility – appearance of eyes in primary position and normal motility in six cardinal positions of gaze.*
 - a. Strabismus – ocular alignment in primary position.*
 - b. Limitation of eye movement.*
 - c. Limitation of gaze (both eyes affected similarly).*
 - d. Nystagmus (spontaneous jerking eye movements).*
 4. Position of the eyelids.*
 - a. Normal lid position.*
 - b. Upper eyelid retraction.* (REF. 4 Fig. 8.9)
 - c. Upper eyelid ptosis.*
 5. Pupillary reflexes.* (REF. 4 Fig. 7.2)
 6. Direct ophthalmoscopy.*
- D. How to interpret findings.
 1. Pupillary disorders.* (REF. 24 Slide 09, 11) (REF. 4 Fig. 7.2)
 - a. Dilated pupil.* (REF. 24 Slide 10)
 - i. Unilateral.*
 - ii. Bilateral.*
 - b. Adie's tonic pupil.** (REF. 24 Slide 16)
 - c. Relative afferent pupillary defect.* (REF. 4 Fig. 7.2)
 - d. Unilateral small pupil.** (REF. 24 Slide 12, 15) (REF. 4 Fig. 7.3) (REF. 10 Fig. 26-3 Right Horner syndrome, the first sign of localized intrathoracic neuroblastoma in a 6-month-old boy)

2. Neuro-motility abnormalities.*
 - a. Cranial nerve palsies.* (REF. 2B Slide 70) (REF. 24 Slides 17 – 19)
 - i. III nerve.* (REF. 2B Slide 71) (REF. 2F Slide 61) (REF. 24 Slide 18) (REF. 4 Fig. 7.5); Pupil not involved vasculopathic, not urgent.* (REF. 22 Fig. H19); Pupil involved, compressive lesion, urgent referral.* (REF. 9 Figs. 14 – 16) (REF. 24 Slide 19)
 - ii. IV nerve.* (REF. 4 Fig. 7.6) (REF. 22 Fig. E01, E02)
 - iii. VI nerve.* (REF. 2B Slide 72) (REF. 4 Fig. 7.7) (REF. 22 Fig. H20 – 22, E03 – E05)
 - b. Other cranial nerve palsies.**
 - i. V cranial nerve.**
 - ii. VII cranial nerve.**
 - c. Myasthenia gravis.** (REF. 2F Slide 75) (REF. 24 Slide 21, 22)
 - d. Intranuclear ophthalmoplegia.** (REF. 24 Slide 20) (REF. 4 FIG 7.8 and 7.9)
 - e. Nystagmus.**
3. Optic nerve disease.*
 - a. Optic disc elevation. (REF. 24 Slide 04)*
 - i. Congenital anomalous disc elevation.**
 - ii. Papilledema.* (REF. 2F Slide 10 – 12) (REF. 24 Slide 8) (REF. 2 Case 14, Papilledema, p.28) (REF. 22 Fig. E16)
 - iii. Papillitis.** (REF. 24 Slide 5)
 - iv. Ischemic optic neuropathy.** (REF. 2B Slide 73) (REF. 2F Slide 58, 59) (REF. 3 Case 11, Anterior Ischemic Optic Neuropathy, p.22) (REF. 22 Fig. E09) (REF. 29 Giant cell arteritis)
 - b. Amaurosis fugax.** (REF. 2F Slide 16 – 20)
 - c. Optic atrophy.** (REF. 3 Case 3, Optic Atrophy, p.6)
 - d. Visual field defect.** (REF. 4 Fig. 7.12)
4. Visual field defects.* (REF. 24 Slide 23 – 25) (REF. 22 Fig. E28)
 - a. Scotoma.***
 - b. Hemianopia.* (REF. 4 Fig. 7.12) (REF. 22 Fig. E25)
 - c. Homonymous hemianopia.* (REF. 4 Fig. 7.12)
 - d. Bitemporal hemianopia.* (REF. 4 Fig. 7.12) (REF. 22 Fig. E26, E27)

Clinical Competencies

Students should:

- ▶ Measure visual acuity with near card.*
- ▶ Perform confrontation visual field testing in four quadrants for each eye.*
- ▶ Test pupillary function and recognize a relative afferent pupillary defect.*
- ▶ Perform test of ductions and versions and recognize acute onset cranial nerve palsies III, IV, VI which require immediate referral.*
- ▶ Recognize and diagnose nystagmus.*
- ▶ Examine the optic disc with the direct ophthalmoscope and recognize optic nerve pallor and papilledema.*

VI. Vitreoretinal Diseases

Educational goal: Students should understand the normal appearance and function of the retina. They should recognize abnormal anatomy and the signs and symptoms of conditions that are associated with important causes of visual loss, such as macular degeneration, diabetic retinopathy, central retinal artery, and central retinal vein occlusion.

- A. Anatomy of vitreous and retina.* (REF. 22 Fig. G07, K54, K55)
1. Vitreous.**
 2. Normal retinal blood vessel walls.*
 - a. Arterioles.*
 - b. Venules.*
 3. Location of rods and cones in retina relative to vitreous and choroid.**
 4. Retinal pigment epithelium.**
 5. Macula.*
 6. Choroid.**
- B. Symptoms suggestive of vitreoretinal disorders.**
1. Flashes.** (REF. 2B Slide 67)
 2. Floaters.** (REF. 4 Fig. 1.5)
 3. Blurring, distortion, and/or minimalization of central visual acuity.**
 4. Abrupt or progressive dimming of vision in one eye.**
 5. Abrupt or progressive loss of peripheral visual field in one eye.**
- C. Examination of the normal eye with direct ophthalmoscopy.* (REF. 2G Slide 25, 26) (REF. 22 Fig. I03)
1. Red reflex.* (REF. 2G Slide 23)
 2. Optic disc.*
 3. Retinal arterioles and venules.* (REF. 4 Fig. 1.18)
 4. Posterior retina and choroid.*
- D. Abnormal fundus features with direct ophthalmoscopy.*
1. General.*
 - a. Loss of normal red reflex.* (REF. 2G Slide 7) (REF. 22 Fig. K72)
 - b. Dark spots in red reflex.*
 - c. Abnormal color of red reflex.*
 2. Fundus features of important systemic diseases.*
 - a. Diabetes mellitus.*
 - i. Background diabetic retinopathy.* (REF. 2B Slide 57) (REF. 2A Slides 18–22, 24) (REF. 22 Fig. K14, K15, K40)
 - ii. Proliferative diabetic retinopathy.* (REF. 2A Slide 26–28, 30) (REF. 22 Fig. K41)
 - b. Systemic hypertension.*
 - i. Vasospastic (accelerated) retinopathy.*
 - ii. Sclerotic (chronic) retinopathy.*
Atherosclerotic carotid occlusive disease.*
 - iii. Central retinal vein occlusion.** (REF. 2B Slide 63) (REF. 3 Case 21, Central Retinal Vein Occlusion, p. 42) (REF. 22 Fig. K37)
 - iv. Branch retinal vein occlusion.** (REF. 2B Slide 64) (REF. 22 Fig. K20)
 - c. Embolic cardiovascular disease and atherosclerotic carotid occlusive disease.*
 - i. Central retinal artery occlusion.** (REF. 3 Case 19, Central Retinal Artery Occlusion, p.3) (REF. 2B Slide 61) (REF. 22 Fig. K34–36)
 - ii. Branch retinal artery occlusion.** (REF. 2B Slide 62) (REF. 22 Fig. K18, K19)
 - d. AIDS.** (REF. 2F Slide 82–84) (REF. 22 Fig. K29)
 - e. Disseminated metastatic cancer.** (REF. 2F Slide 34–36)
 3. Fundus features of important ocular diseases.*
 - a. Retinoblastoma.* (REF. 2G Slide 7) (REF. 22 Fig. H27–29)
 - b. Retinal detachment.** (REF. 2B Slide 68, 69) (REF. 22 Fig. K70–72)
 - c. Age-related macular degeneration.* (REF. 2B Slide 24–27) (REF. 3 Case 17, Age-Related Macular Degeneration, p. 34) (REF. 22 Fig. K3–K5)
- E. When to refer patient to an ophthalmologist.*
1. Abnormal red reflex or fundus.**
 2. Visual loss or symptoms consistent with a vitreoretinal disorder.**
- Clinical Competencies**
- Students should:
- ▶ Understand anatomy and function of retina.*
 - ▶ Understand definition and function of the macula.*
 - ▶ Understand importance of dilated fundus exam.*
 - ▶ Recognize a change in red reflex.*
 - ▶ Recognize normal retinal vasculature.*
 - ▶ Detect diabetic background and proliferative retinopathy.*
 - ▶ Understand definition and importance of retinal detachment.**
 - ▶ Understand importance of retinoblastoma and recognize leukocoria.*
- VII. Glaucoma**
- ▼
- Educational goal: Students should understand the anterior segment anatomy and understand the circulation of aqueous humor in the normal human eye and in primary open angle glaucoma and primary angle closure glaucoma. Students should recognize the risk factors, signs, and symptoms of primary open angle glaucoma and angle closure glaucoma.
- A. Anatomy.*
1. Aqueous humor.*
 - a. Production.**
 - i. Ciliary body.**
 - b. Circulation.** (REF. 2D Slide 10) (REF. 2B Slide 35, 46)
 - i. Movement from posterior chamber through pupil into anterior chamber.**
 - c. Outflow pathway.* (REF. 2D Slide 11, 13)
 - i. Trabecular meshwork in anterior chamber angle.* (REF. 22 Fig. C12)
 - ii. Uveoscleral outflow tract.**
 2. Optic Nerve.*
 - a. “Glaucoma may be defined as an optic neuropathy usually with characteristic optic nerve head and visual field changes.”* (REF. 2B Slide 33) (REF. 2D Slide 3)
 - i. Injury to axons from retinal ganglion cells at lamina cribrosa.*
 - ii. Signs of optic nerve injury.*
 - (a) Increased size of central cup.* (REF. 22 Fig. C06, C54, C55)
 - (b) Asymmetric cupping.*
 3. Organization of axons and associated visual field defects.** (REF. 2D Slide 5) (REF. 22 Fig. C26)
- B. Examination.*
1. Central visual acuity measurement.*
 2. Visual field testing.*
 - a. Confrontation testing with finger counting in four quadrants of each eye.*
 - b. Central color testing – red top bottle.**
 3. Pupillary reaction.*

Relative afferent pupillary defect as sign of unilateral optic nerve injury.*

4. Penlight examination.* (REF. 4 Fig. 1.10)
 - Anterior chamber depth estimation.*
 - a. Normal.*
 - b. Narrow.*
 5. Intraocular pressure.***
 - a. Applanation tonometry.*** (REF. 22 Fig. C29)
 - b. Normal value range. Direct ophthalmoscopy of signs of glaucomatous optic neuropathy.* (REF. 2B Slide 33) (REF. 22 Fig. C53 – 56)
- C. How to interpret history and risk factors.*
1. Primary open angle glaucoma.* (REF. 2D Slide 9) (REF. 3 Case 12, Primary Open Angle Glaucoma, p.24)
 - a. Risk factors.* (REF. 2B Slide 32) (REF. 4 Table 3.1)
 - i. Increased intraocular pressure.*
 - ii. African and Caribbean ancestry.*
 - iii. Age greater than 75 years.*
 - iv. Primary family member with glaucoma.*
 - b. Genetic influence.***
 - GLC1A (myocilin gene) juvenile open angle glaucoma.***
 - c. Symptoms.*
 - Lack of symptoms until late in disease.*
 2. Normal tension glaucoma.***
 - a. Optic nerve injury and visual field loss similar to primary open angle glaucoma.***
 - b. Not associated with elevated intraocular pressure.***
 3. Primary angle closure glaucoma.* (REF. 2B Slide 46, 47) (REF. 22 Fig. C01, C05, C09)
 - a. Risk factors.**
 - i. Anatomically narrow anterior chamber angle.**
 - ii. Hyperopia.**
 - iii. Dilating drops in eyes with narrow angles.**
 - iv. Anti-cholinergic medications.**
 - v. Older age.**
 - vi. Some Asian populations.** (REF. 2B Slide 45)
 - b. Symptoms.*
 - i. Ocular pain (may be severe).*
 - ii. Ocular redness.*
 - iii. Blurred vision, colored halos, nausea.*
 - c. Signs.*
 - i. Dilated fixed pupil.* (REF. 2B Slide 47)
 - ii. Narrow anterior chamber angle.*
 - iii. Pupillary block.*
 - iv. Corneal edema.*
- D. Pharmacological treatment for open angle glaucoma.** (REF. 2B Slide 37, 38) (REF. 22 Fig. C02 – 04)
1. Topical medications that increase aqueous humor outflow.**
 - a. Parasympathomimetics.** (REF. 2B Slide 41)
 - b. Prostaglandin analogues.** (REF. 2B Slide 42)
 2. Medications that decrease aqueous production.**
 - a. Topical beta blockers.** (REF. 2B Slide 39)
 - b. Oral carbonic anhydrase inhibitors.** (REF. 2B Slide 43)
 - c. Alpha-2-agonists.**
 - d. Adrenergic agonists.** (REF. 2B Slide 40)
- E. Surgical treatment.***
1. Primary acute angle closure glaucoma.***
 - a. Peripheral iridectomy.*** (REF. 22 Fig. C46, C47, C48)
 2. Primary open angle glaucoma.*** (REF. 2B Slide 44)
 - a. Laser trabeculoplasty.*** (REF. 22 Fig. C38)
 - b. Filtering surgery.*** (REF. 22 Fig. C41 – C43, C49 – C51)

Clinical Competencies

Students should:

- ▶ Obtain history to determine risk factors for primary open angle glaucoma.*
- ▶ Measure visual acuity with near card.*
- ▶ Perform confrontation visual field testing in four quadrants for each eye.*
- ▶ Assess pupillary reactions for relative afferent defect.*
- ▶ Estimate anterior chamber depth with penlight.*
- ▶ Diagnose primary angle closure glaucoma by history and penlight examination.*
- ▶ Recognize signs of optic nerve injury – increased cupping and asymmetric cupping.*

VIII. Pediatric Ophthalmology and Strabismus



Educational Goal: Students should understand the normal anatomy of the extraocular muscles and normal ocular alignment. Students should understand the principles of abnormal ocular alignment, such as exotropia and esotropia, and the risk of amblyopia in children. They should understand that infants and children with loss of red reflex require immediate ophthalmologic evaluation.

A. Anatomy of the extraocular muscles and their fascia.*

(REF. 22 Fig. G13)

1. Origin, course, insertion, innervations, and action of the extraocular muscles.*
 - a. Horizontal rectus muscles.*
 - b. Vertical rectus muscles.*
 - c. Oblique muscles.*
 - d. Levator palpebrae superioris muscle.*
 - e. Insertion relationships of the rectus muscles.*
 2. Blood supply of the extraocular muscles.***
 - a. Arterial.***
 - b. Venous.***
 3. Fine structure of the extraocular muscles.**
 - a. Fiber types.**
- B. Amblyopia.* (REF. 2G Slide 10 – 15) (REF. 3 Case 22, Esotropia and amblyopia, p. 44)
1. Strabismic amblyopia major cause of unilateral decreased visual acuity in children.** (REF. 2G Slide 14, 17)
 2. Refractive amblyopia.** (REF. 2G Slide 12, 13)
 3. Form deprivation and occlusion amblyopia.** (REF. 2G Slide 11)
- C. Strabismus.*
1. Concomitant strabismus.** (REF. 4 Fig. 6.3)
 2. Incomitant strabismus.** (REF. 4 Fig. 6.4)
 3. Heterotropia.* (REF. 4 Table 6.1 and Figure 6.5)
 - a. Esophoria: inward deviation – not manifest.***
 - b. Esotropia: inward deviation – manifest.* (REF. 2G Slide 17, 37) (REF. 22 Fig. H07, H08)
 - c. Exophoria: outward deviation – not manifest.***
 - d. Exotropia: outward deviation – manifest.* (REF. 2G Slide 37) (REF. 22 Fig. H09 – 12)
 - e. Hyperphoria: upward deviation – not manifest.***
 - f. Hypertropia: upward deviation – manifest.* (REF. 9 IV Nerve Palsy, Fig. 8 – 14)
 - g. Hypophoria: downward deviation – not manifest.***
 - h. Hypotropia: downward deviation – manifest.* (REF. 2C Slide 29)

- D. Examination of the eyes.*
1. Visual acuity and amblyopia.*
 - a. Newborns.***
 - b. Infants to two years old.** (REF. 2G Slide 29, 30)
 - c. Two to four years old.** (REF. 2G Slide 32, 33) (REF. 4 Fig. 6.6)
 - d. Four to five years old and up.** (REF. 2G Slide 34)
- E. Strabismus testing.*
1. General inspection.*
 2. Corneal light reflex – Hirschberg test. (REF. 2G Slide 36–38) (REF. 4 Fig. 6.11) (REF. 22 Fig. H06).**
 3. Cover test. (REF. 4 FIG.6.12)
 4. Other tests.**
 - a. Red reflex.** (REF. 2G Slide 19, 23)
 - b. Ophthalmoscopy. (REF. 2G Slide 24–27)
 - c. Pupillary testing.**
- F. Leukocoria.*
1. Retinoblastoma.* (REF. 4 Fig. 6.14) (REF. 22 Fig. H27–H29)
 2. Persistent Hyperplastic Primary Vitreous (PHPV).*** (REF. 22 Fig. H39, H40)
 3. Retinopathy of Prematurity (ROP).** (REF. 10 Stages of retinopathy of prematurity, Fig. XXIV-2–XXIV-6 p. 304) (REF. 22 Fig. H32–H36)
 4. Cataract.** (REF. 2G Slide 42)
- G. Management or referral.*
1. Amblyopia.* (REF. 2G Slide 39)
 2. Strabismus.*
 3. Leukocoria – cause for urgent referral.*
- Clinical Competencies**
- Students should:
- ▶ Perform visual acuity testing in each eye in preverbal children by fixation and recognizing fixation preference, if present.**
 - ▶ Understand the importance of measuring visual acuity in children two to five years old with Allen cards, HOTV test, or tumbling E card with each eye.***
 - ▶ Recognize and characterize ocular misalignment (strabismus) by performing Hirschberg testing.*
 - ▶ Recognize leukocoria and importance.*
 - ▶ Understand the importance for urgent referral for leukocoria, amblyopia, and strabismus in a child.*
- IX. Diseases of Eyelid, Lacrimal System, and Orbit**
- ▼
- Educational goal: Students should understand the normal anatomy of the adnexal structures and the presenting signs and symptoms of serious conditions associated with ocular and systemic morbidity, such as orbital cellulitis.
- A. Eyelid.*
1. Examination and Technique.**
 - a. Assess the position of the upper eyelid by measuring the distance between the lid margin and the corneal light reflex (margin-reflex distance).**
 - b. Visual inspection of eyelids and periocular area.**
 2. Normal anatomy.**
 - a. Anterior and posterior lamellae.***
 - b. Lid margin.** (REF. 2E Fig. 10, REF. 2E Fig. 12)
 - c. Orbital septum relationship to eyelid/orbit.**
 - d. Eyebrow.**
 - e. Levator aponeurosis.**
 - f. Blood supply – internal and external carotid circulation.***
 - g. Sensory supply – V₁ and V₂.*
 - h. Motor supply – cranial nerve III, cranial nerve VII, and upper eye lid sympathetic innervations.**
3. Eyelid Diseases.*
- a. Malpositions.*
 - i. Blepharoptosis.** (REF. 2B Slide 20)
 - ii. Dermatochalasis.**
 - iii. Entropion.* (REF. 2B Slide 18) (REF. 22 Fig. F17–20)
 - iv. Ectropion.* (REF. 2B Slide 19) (REF. 22 Fig. F14, F15)
 - v. Retraction.* (REF. 11 Fig. 12–18)
 - vi. Lagophthalmos.* (REF. 11 Fig. 12, 13)
 - b. Inflammations.*
 - i. Chalazion.* (REF. 2E Fig. 13, 14)
 - ii. Blepharitis.* (REF. 2E Fig.16, 18)
 - iii. Meibomitis.** (REF. 22 Fig. B49)
 - c. Infections.*
 - i. Hordeolum.* (REF. 2E Fig. 11) (REF. 22 Fig. B43)
 - ii. Preseptal cellulitis.** (REF. 22 Fig. H43)
 - iii. Orbital cellulitis.* (REF. 2E Fig.19–23)
 - iv. Herpes Zoster Ophthalmicus.** (REF. 2B Slide 23)
 - d. Tumors.*
 - i. Benign.***
 - ii. Cysts.***
 - iii. Nevi.**
 - iv. Papillomas.**
 - v. Xanthelasma.* (REF. 8 Fig 13–6)
 - vi. Malignant.**
 - (a) Basal cell carcinoma.** (REF. 2B Slide 21) (REF. 3 Case 20, Basal Cell Carcinoma, p. 40) (REF. 22 Fig. F02, F03)
 - (b) Squamous cell carcinoma.**
 - (c) Eyelid trauma.** (REF. 2C Slide 32, 33) (REF. 22 Fig. F53, F54)
- B. Lacrimal System.**
1. Examination technique.**
 - a. Visual inspection of medial canthal area.* (REF. 2C Slide 34)
 2. Anatomy.** (REF. 1 Fig. 24)
 - a. Upper lacrimal system – puncta, canaliculi, and lacrimal sac.*
 - b. Lower lacrimal system – bony and mucosal nasolacrimal duct.***
 3. Lacrimal diseases.**
 - a. Congenital nasolacrimal duct obstruction.**
 - b. Acquired nasolacrimal duct obstruction.**
 - c. Dacryocystitis.** (REF. 2E Slide 25) (REF. 22 Fig. F13)
 - d. Lacrimal trauma.**
- C. Orbit.*
1. Examination technique.*
 - a. Observe laterally and superiorly to compare both eyes to identify axial proptosis.*
 - b. Exophthalmometer.***
 2. Anatomy.**
 - a. Seven bones comprise four walls: floor, medial and lateral walls, and roof.*** (REF. 4 Fig. 5.1)
 - b. Orbital septum relationship to orbit.**
 - c. Contents of orbit: extraocular muscles, lacrimal system, ophthalmic artery, cranial nerves (II, IV, V, VI, sympathetic, and parasympathetic).**
 - d. Relationship of orbit to surrounding structures: sinuses, cranial cavity.**

3. Orbital diseases.*

- a. Orbital cellulitis – life threatening condition requiring urgent referral.* (REF. 2E Slide 19–23)
- b. Thyroid eye disease (Graves' ophthalmopathy).* (REF. 2F Slide 64, 74)
- c. Orbital inflammatory disease.**
- d. Orbital tumors.***
 - i. Muscle.*** (REF. 10 Fig 26-1 Rhabdomyosarcoma in a 4-year-old boy presenting with right upper eyelid ptosis of 3 weeks duration and a palpable subcutaneous mass)
 - ii. Vascular.*** (REF. 10 Fig. 26-5 Capillary hemangioma in a 2-month-old girl involving the right upper eyelid and orbit with displacement of the globe and induction of 8D of astigmatic error)
 - iii. Neural.*** (REF. 11 Fig. 8a-8f)
 - (a) Clinical photograph of a child with a right optic nerve glioma displaying proptosis and esotropia.***
 - (b) Fundoscopic view of the same patient.***
 - (c) fMRI imaging studies.***
 - iv. Lacrimal.*** (REF. 11 Fig. 5–17 a, b, c)
 - (a) Proptosis and downward displacement of the left eye in a man with benign mixed tumor of the lacrimal gland.***
 - (b) Axial CT scan.*** (REF. 22 Fig. F25–29)
 - (c) Coronal CT study.***
 - v. Metastatic.*** (REF. 10 Fig. 26-2 Bilateral orbital metastases of neuroblastoma presenting with bilateral ecchymosis in a 2-year old child)
 - (a) Orbital trauma.*** (REF. 2C Slide 36–38)
 - (b) Blowout fracture.*** (REF. 2C Slide 29, 30) (REF. 22 Fig. F38–42)

Clinical Competencies

Students should:

- ▶ Understand structure and function of eyelids, commonly associated malpositions, and acquired disorders.*
- ▶ Understand tear production and drainage.**
- ▶ Understand orbital structure and common abnormalities.**
- ▶ Understand the importance of orbital cellulitis as a potentially life threatening condition that requires emergent attention.**

X. Ocular Manifestations of Systemic Diseases

Educational goal: Students should understand the signs and symptoms of ocular conditions that are associated with important systemic diseases and diagnoses, such as congenital, traumatic, vascular, neoplastic, autoimmune, idiopathic, infectious, metabolic or endocrine, and pharmacologic or toxic conditions.

A. Congenital.*** (REF. 2F Slide 4–6)

- a. Neurofibromatosis.*** (REF. 22 Fig. E08)

B. Trauma. (REF. 2F Slide 7)

- a. Shaken baby syndrome.***

C. Vascular causes.*

1. Hypertension.* (REF. 3 Case 5, Hypertensive Retinopathy, p. 10)
 - a. Posterior segment.* (REF. 2F Slide 8–10)
 - i. Arteriolar narrowing.* (REF. 2F Slide 9)
 - (a) Copper wire.*
 - (b) Silver wire.*

ii. Hemorrhages (flame-shaped).*

- (a) Exudates (cotton wool spots, macular star).*
- iii. Papilledema (malignant hypertension).* (REF. 2F Slide 10)

2. Intracranial hypertension.* (REF. 2F Slide 11, 12)

3. Embolic Hollenhorst plaque.** (REF. 2F Slide 13–15) (REF. 21 Fig. K47)

4. Amaurosis fugax.** (REF. 2F Slide 16–20)

- a. Transitory Ischemia Attack (TIA).* (REF. 2F Slide 13)
 - i. Visual changes.*
 - ii. Fundus findings.** (REF. 2F Slide 18)
- b. Cerebrovascular accident – stroke.*
 - i. History.*
 - ii. Visual field findings.* (REF. 4 Fig. 7.12)
 - (a) Homonymous hemianopia.*
 - (b) Homonymous quadrantanopia.*

5. Central retinal vein occlusion.*** (REF. 2F Slide 21) (REF. 22 Fig. K37)

6. Migraine.*** (REF. 2F Slide 22–24)

7. Blood dyscrasias.** (REF. 2F Slide 25–32)

- a. Sickle cell anemia.**
 - i. Anterior segment.**
 - (a) Importance of recognizing traumatic hyphema as a risk for acute vision loss.*
 - (b) Anterior segment ischemia.***
 - ii. Posterior segment.*** (REF. 2F Slide 30–32)
 - (a) Salmon patch.***
 - (b) Black sunburst.***
 - (c) Sea fan.***

D. Malignancy.** (REF. 2F Slide 33)

1. Primary.*

- a. Intraocular.**
 - i. Retinoblastoma.* (REF. 22 Fig. H27–H29)
 - ii. Uveal malignant melanoma.** (REF. 3 Case 7, Malignant Choroidal Melanoma, p. 14) (REF. 22 Fig. K25, K26)
 - iii. Lymphoma.*** (REF. 2B Slide 65)
- b. Eyelid.**
 - i. Basal cell carcinoma.** (REF. 21 Fig. F02, F03)
 - ii. Sebaceous carcinoma.**
 - iii. Melanoma.***
- c. Orbit.***
 - i. Lymphoma.***
 - ii. Lacrimal gland tumors.*** (REF. 22 Fig. F25–29)
 - iii. Other.***

2. Secondary.***

- a. Extension from sinus carcinoma.***
- b. Metastasis.***
 - i. Adults-carcinoma.*** (REF. 2F Slide 34–36)
 - ii. Children-leukemia – Roth Spots.*** (REF. 2F Slide 28)

E. Autoimmune disease.* (REF. 2F Slide 39–76)

1. Thyroid eye disease (Graves' ophthalmopathy).* (REF. 3 Case 4, Endocrine Ophthalmopathy, p.8)

- a. Clinical (Werner classification of severity of ophthalmopathy).** (REF. 2F Slide 66–71)
- b. Treatment for thyroid orbitopathy.**
 - i. Non-surgical.***
 - (a) Corticosteroids.***
 - (b) Radiation.***

- ii. Surgical.***
 - (a) Eyelid.*** (REF. 22 Fig. F52)
 - (b) Orbital decompression.***
- 2. Rheumatoid arthritis.** (REF. 2F Slide 46–51)
 - a. Dry eyes.** (REF. 22 Fig. B05)
 - b. Episcleritis.** (REF. 2F Slide 47) (REF. 22 Fig. B50)
 - c. Scleritis.** (REF. 2F Slide 48–50)
 - d. Peripheral corneal ulceration.** (REF. 2F Slide 51) (REF. 21 Fig. B25)
- 3. Myasthenia gravis.**
 - a. Ocular motility disturbance – noncomitant.**
 - b. Lid eye malposition – ptosis.** (REF. 2F Slide 75)
- 4. Wegener's granulomatosis.**
 - a. Orbital involvement.** (REF. 11, Fig. 4-11 a,b,c)
- F. Sarcoidosis and other inflammatory diseases.** (REF. 3 Case 10, Sarcoid uveitis, p 20.)
 - 1. Sarcoidosis.**
 - a. Clinical findings.**
 - i. Eyelid nodules.**
 - ii. Conjunctival nodules.**
 - b. Uveitis – granulomatous versus nongranulomatous.**
 - i. Non-granulomatous associated systemic diseases: juvenile rheumatoid arthritis, Reiter's syndrome, Behçet's disease.*** (REF. 30)
 - ii. Granulomatous (associated diseases-sarcoidosis, Tuberculosis, fungal).*** (REF. 2F Slide 78)
 - c. Choroiditis and retinal vasculitis.** (REF. 2F Slide 79)
 - d. Diagnostic tests.**
 - i. Imaging, gallium scan.***
 - ii. ACE level.**
 - 2. Behçet's disease.***
 - a. Clinical triad findings.** (REF. 13 Fig 7-15-17) (REF. 30)
 - i. Acute iritis with hypopyon.***
 - ii. Aphthous stomatitis (canker like mouth ulcers).***
 - iii. Genital ulceration.***
- G. Infectious.**
 - 1. AIDS.**
 - a. Adnexal.**
 - i. Bacterial infections of the lids and adnexa.** (REF. 19, Fig. 4–10 Fatal orbital cellulitis due to Staphylococcus aureus, p.41)
 - ii. Kaposi's sarcoma.* (REF. 19 Fig. 4-2 Extensive Kaposi's sarcoma of face and eyelids, limiting vision, p.37)
 - iii. Non-Hodgkin's lymphoma.*** (REF. 19 Fig. 4–11, Bilateral lid swelling due to orbital lymphoma p. 41)
 - b. Conjunctiva.***
 - i. Kaposi's sarcoma.*** (REF. 19 Fig. 4-3 Kaposi's sarcoma in the inferior cul-de-sac, mimicking subconjunctival hemorrhage, Fig. 4-4)
 - (a) Multiple Kaposi's sarcoma lesions on bulbar conjunctiva.***
 - (b) High power view of one such lesion reveals its vascular nature.***
 - (c) Squamous cell carcinoma ophthalmology.*** (REF. 19 Fig. 4-6 Squamous cell carcinoma of conjunctiva of superior limbus p. 39)
 - c. Posterior segment.*** (REF. 2F Slide 82)
 - i. CMV retinitis.* (REF. 2F Slide 84) (REF. 3 Case 25, Cytomegalovirus Retinitis, p.50) (REF. 21 Fig. K29)
 - ii. Cotton wool patches.* (REF. 2F Slide 83)
 - 2. Syphilis.***
 - a. Anterior segment.***
 - i. Interstitial keratitis.***
 - ii. Anterior uveitis.***
 - b. Posterior segment.***
 - i. Neuroretinitis.***
 - ii. Papillitis.***
 - iii. Posterior uveitis.***
 - 3. Other systemic infections.*
 - a. Viral (herpes zoster ophthalmicus "shingles").* (REF. 4 Fig. 8.13)
 - b. Fungal (e.g., Candida endophthalmitis).***
 - c. Bacterial (e.g., TB uveitis).***
 - d. Toxoplasmosis.*** (REF. 22 Fig. K82–85)
 - e. Onchocerciasis.*** (REF. 17, Fig 21 1-2 and 1-3)
 - H. Diabetes.*
 - 1. Anterior segment.*
 - a. Corneal wound healing.***
 - b. Cataract.*
 - 2. Posterior segment.
 - a. Diabetic retinopathy.* (REF. 2A Slide 18, 19, 34)
 - i. Background retinopathy – hard exudates.* (REF. 22 Fig. K40), hemorrhages, microaneurysms (REF. 2A Slide 19–22, 24) (REF. 3 Case 1, Nonproliferative Diabetic Retinopathy, p. 2) (REF. 22 Fig. K14, K15, K40, K41)
 - ii. Preproliferative retinopathy – soft exudates, intraretinal microvascular abnormality.*** (REF. 2A Slide 25)
 - iii. Proliferative retinopathy – neovascularization of the disc. (REF. 22 Fig. K41) neovascularization elsewhere (REF. 2A Slide 26, 27) vitreous hemorrhage.** (REF. 22 Fig. K86) (REF. 2A Slide. 28) (REF. 3 Case 9, Proliferative Diabetic Retinopathy, p. 18)
 - b. Ischemic optic neuropathy.***

Clinical Competencies

Students should:

- ▶ Recognize retinal exudates and hemorrhages on dilated fundus exam.*
- ▶ Understand importance of traumatic hyphema in sick cell anemia.***
- ▶ Recognize retinal arteriolar narrowing (copper wire/silver wire) on dilated fundus exam.*
- ▶ Detect disc edema on fundus exam with direct ophthalmoscopy.*
- ▶ Perform neurologic assessment of all cranial nerves.*
- ▶ Perform confrontational visual fields with recognition of hemianopias.*
- ▶ Recognize limited ocular motility.*
- ▶ Recognize proptosis.*
- ▶ Recognize photophobia as symptom of uveitis.*
- ▶ Assess for malignant neoplasms of eyelids (carcinoma, melanoma).***

XI. Intraocular Tumors



Educational goal: Students should understand that malignancy may affect the eye and adnexa and recognize the signs and symptoms of childhood retinoblastoma.

- A. Retinoblastoma.* (REF. 3 Case 27, Leukocoria/Retinoblastoma, p.54) (REF. 22 Fig. H27–29)
 - 1. Knudson's two-hit hypothesis.***

2. Genetics.***
 - a. 13q14 deletion.***
 - b. Heritable vs. sporadic.***
3. Clinical presentation.*
 - a. Leukocoria.*
 - b. Strabismus.*
4. Treatment.***
 - a. Chemotherapy and radiation therapy.***
 - b. Surgical (enucleation).***
5. Differential diagnosis.***
 - a. Retinopathy of Prematurity (ROP).*** (REF. 10, Stages of retinopathy of prematurity, Fig XXIV-2 – XXIV-6 p.304) (REF. 22 Fig. H32 – 36)
 - b. Coats' disease.*** (REF. 22 Fig. K31, K32)
 - c. Persistent Hyperplastic Primary Vitreous.*** (REF. 22 Fig. H39, H40)
- B. Uveal melanoma.** (REF. 3 Case 7, Malignant Choroidal Melanoma, p. 14)
 1. Most common primary intraocular malignancy.**
 2. Variants.***
 - a. Iris.***
 - b. Ciliary body.***
 - c. Choroidal.*** (REF. 22 Fig. K25, K26)
 3. Clinical presentation.*
 - a. Asymptomatic vs. symptomatic.*
 - b. Pigmented vs. amelanotic.***
 4. Prognosis.***
 - a. Size.***
 - b. Cell type.***
 5. Treatment.***
 - a. Non-surgical.***
 - b. Surgical (enucleation).***
 6. Differential diagnosis.***
 - a. Choroidal nevus.***
 - b. Metastasis to eye.***
 - c. Retinal detachment.***
- C. Other intraocular tumors.***
 1. Lymphoma – primary large cell lymphoma vs. systemic lymphoma.***
 2. Metastasis – carcinomas in adults.*** (REF. 2F Slide 35, 36)
 3. Leukemia infiltration of optic nerve.*** (REF. 2F Slide 29)

Clinical Competencies

Students should:

- ▶ Assess red reflex with flashlight/penlight and direct ophthalmoscope.*
- ▶ Assess ocular alignment with Hirschberg test.*
- ▶ Obtain history for risk factors for retinoblastoma.*
- ▶ Recognize retinal detachment/intraocular tumor on fundus exam of adult.***

XII. Refraction and Contact Lenses



Educational goal: Students should understand that the human eye is an optical system and understand the principles of common refractive errors, such as myopia, hyperopia, astigmatism, and presbyopia. Students are expected to know how to measure visual acuity with a near card and near correction.

- A. Refraction States (as it affects direct ophthalmoscopy).*
 1. Emmetropia.* (REF. 7 Fig. 3-9 and Fig. 4-18)
 2. Myopia.* (REF. 7 Fig. 3-10, p.118, and Fig. IV-18) (REF. 22 Fig. G30, G31, G34)

3. Hyperopia.* (REF. 7 Fig. 3-11, p.119) (REF. 22 Fig. G25, G26, G29)
4. Astigmatism.* (REF. 12 Fig 15, 16) (REF. 22 Fig. G21, G22) (REF. Fig. 3-12)
5. Presbyopia and accommodation.* (REF. 7 Table IV-2, Average Accommodative Amplitudes for different ages, p.151)
- B. Spectacle correction.***
 1. Spherical lenses.***
 2. Bifocals, trifocals, multi-focal lenses (progressive lenses).***
- C. Special lens material.***
 1. Plastic.***
 2. Impact resistant high index plastic.***
 3. Polycarbonate lens.***
- D. Contact lenses.***

Clinically important features of contact lens:

 1. Optics.***
 2. Field of vision.***
 3. Image size.***
 4. Hard contact lens.***
 5. Flexible contact lens.***
 6. Therapeutic contact lens.***
- E. Intraocular lens.**

Concept of correcting the refractive error caused by cataract removal.**
- F. Refractive surgery.***

Concept of correcting myopia and hyperopia.***
- G. Patients with low vision.*** (REF. 2B Slide 78, 79) (REF. 16 Table 3-3a, 3-3b) (REF. 22 Fig. D2-9)
 1. Understand that patients may benefit from low vision aids.***
 2. Understand that patients may need special rehabilitation with low vision optical devices.***

Clinical Competencies

Students should:

- ▶ Understand emmetropia, myopia, hyperopia, astigmatism, and presbyopia.**
- ▶ Measure near central acuity in adults with near card and understand measurement of acuity in children with Allen cards or tumbling E card test.*
- ▶ Understand optical principles of contact lens, intraocular lens, and refractive surgery.**
- ▶ Understand the need for low vision rehabilitation.*

XIII. Refractive Surgery



Educational goal: Students should understand the eye as an optical system and should know how refractive surgery corrects common refractive errors of emmetropia, myopia, hyperopia, and astigmatism.

- A. Refractive errors.*
 1. Myopia – long eye, steep cornea, or both.*
 2. Hyperopia – short eye, flat cornea, or both.*
 3. Astigmatism – uneven curvature of cornea.*
 4. Presbyopia – inability to focus at near due to aging.*
- B. Types of surgical techniques to correct refractive errors.***
 1. Incision – weaken cornea structurally to change curvature.*** (REF. 22 Fig. J01, J02, J16)
 2. Lamellar – change cornea shape with addition or removal of tissue.***

3. Thermal – shrink corneal collagen to steepen or flatten the anterior corneal curvatures.***
4. Intraocular lens implantation with or without removal of crystalline lens.***
- C. Newer procedures – with excimer laser.***
 1. Photorefractive keratectomy (PRK).*** (REF. 22 Fig. J17, 18)
 2. Laser in situ keratomileusis (LASIK).*** (REF. 22 Fig. J06-11, J13-15)
- D. Effectiveness of refractive surgery.***
 1. Continual improvement.***
 2. LASIK may be more predictable than radial keratotomy.***
 3. Uncorrected visual acuity of 20/40 or better in most patients.***
 4. Larger range of treatable refractive errors.***
- E. Risks associated with refractive surgery.***
 1. Infection.***
 2. Loss of best-corrected visual acuity.***
 3. Overcorrection, under correction, regression to baseline refractive status.***
 4. Visual aberrations such as glare and halos.***
- F. Success in refractive surgery depends on:
 1. Careful preoperative evaluation.***
 2. Exclusion of systemic diseases and eye disorders that may be contraindicated.***
 3. Options, risks, and benefits of each procedure.***

Clinical Competencies

Students should:

- ▶ Understand refractive errors and their relations to eye length, corneal curvature, and lens status.*
- ▶ Describe refractive surgical theory and practice.***
- ▶ Understand risks and benefits of commonly discussed and performed refractive procedures.***

XIV. References

- ▼
1. The "Atlas of Ophthalmology" (www.atlasophthalmology.com) is an online multimedia database edited by Georg Michelson, MD, from the University Augenklinik in Erlangen, Germany and Robert Machemer, MD, from Duke University in Durham, North Carolina, USA. It is endorsed by the ICO.
 2. Coleman AL. Eye care skills on CD-ROM. A. Diabetes and eye disease; B. Eye care for the elderly; C. Eye trauma and emergencies; D. Glaucoma: Diagnosis and management; E. Managing the red eye; F. Ocular manifestations of systemic disease; and G. Understanding and preventing amblyopia. San Francisco: American Academy of Ophthalmology; 2001: Slides 1 – 85
 3. Mannis MJ, Smith M. Case studies in ophthalmology for medical students. Instructor manual. 2nd ed. San Francisco: American Academy of Ophthalmology; 1993–2003: Cases 1–24
 4. Bradford CA. Basic ophthalmology. 8th ed. San Francisco, CA: American Academy of Ophthalmology; 2004
 5. Bradford CA. Basic ophthalmology for medical students and primary care residents. 7th ed. San Francisco: American Academy of Ophthalmology; 1999
 6. Cibis GW. Basic and clinical science course. Section 2. 2005–2006, Fundamentals and principles of ophthalmology. San Francisco: American Academy of Ophthalmology; 2005; 528
 7. Miller KM. Basic and clinical science course. Section 3. 2005–2006, Optics, refraction, and contact lenses. San Francisco: American Academy of Ophthalmology; 2005: 347
 8. Grossniklaus HE. Basic and clinical science course. Section 4. 2005–2006, Ophthalmic pathology and intraocular tumors. San Francisco: American Academy of Ophthalmology; 2005:332
 9. Kline LB. Basic and clinical science course. Section 5. 2005–2006, Neuro-ophthalmology. San Francisco: American Academy of Ophthalmology; 2005: 400
 10. Simon JW. Basic and clinical science course. Section 6. 2005–2006, Pediatric ophthalmology and strabismus. San Francisco: American Academy of Ophthalmology; 2005: 482
 11. Kersten R. Basic and clinical science course. Section 7. 2005–2006, Orbit, eyelids, and lacrimal system. San Francisco: American Academy of Ophthalmology; 2005: 324
 12. Sutphin JE. Basic and clinical science course. Section 8. 2005–2006, External disease and cornea. San Francisco: American Academy of Ophthalmology; 2004; xiv: 324
 13. Opremcak EM. Basic and clinical science course. Section 9. 2005–2006, Intraocular inflammation and uveitis. San Francisco: American Academy of Ophthalmology; 2005: 300
 14. Simmons ST. Basic and clinical science course. Section 10. 2005–2006, Glaucoma. San Francisco: American Academy of Ophthalmology; 2005:242
 15. Rosenfeld SI. Basic and clinical science course. Section 11. 2004–2005 Lens and cataract San Francisco: American Academy of Ophthalmology; 2005
 16. Regillo C. Basic and clinical science course. Section 12. 2005–2006, Retina and vitreous. San Francisco: American Academy of Ophthalmology; 2005: 382
 17. VanNewkirk M. Basic and clinical science course. Section 13. 2004–2005, International ophthalmology. San Francisco: American Academy of Ophthalmology; 2003
 18. Weiss JS. Basic and clinical science course. Section 14. 2004–2005, Refractive surgery. San Francisco: American Academy of Ophthalmology; 2003
 19. Cunningham ET, Jr, Belfort R. HIV/AIDS and the eye: A global perspective. Ophthalmology monographs 15. San Francisco: American Academy of Ophthalmology; 2002
 20. Flynn HT, Jr., Smiddy WE. Diabetes and ocular disease: Past, present, and future therapies. Ophthalmology monographs 14. San Francisco: American Academy of Ophthalmology; 2000
 21. Kline LB. Optic nerve disorders. Ophthalmology monographs 10. San Francisco: American Academy of Ophthalmology; 1996
 22. Ophthalmic images collection. CD-ROM. San Francisco: American Academy of Ophthalmology; V.3, figure
 23. Lightman S. Medical lecture. Diabetic retinopathy. London, UK: 2003–2004; Slides 1 – 14
 24. Lightman S. Undergraduate medical lecture. Neuro-ophthalmology. London, UK: 2003–2004; Slides 1 – 25
 25. Lightman S. Undergraduate medical lecture. Systemic disease and the eye: Diabetic retinopathy 2–9; Central retinal vein occlusion 10; Central retinal artery occlusion 11; Thyroid eye disease 12–17; Sacroidosis 18–31; Phacomatoses 32–47; Rheumatoid arthritis 48; Wegener's granulomatosis and polyarteritis nodosa 49; Giant cell arteritis 50–56; Ocular manifestations of HIV infection 57–89. London, UK: 2003–2004; Slides 1 – 97

26. Lightman S. Undergraduate medical lecture. Visual loss in the elderly: Cataract 3 – 7; Glaucoma 8 – 12; Anterior ischemic optic neuropathy 13 – 14; Retinal vein occlusion 15; Central retinal vein occlusion 16 – 17; Macular disease 18 – 20. London, UK: 2003 – 2004; Slides 1 – 20
27. Lightman S. Undergraduate medical lecture: Ocular manifestations of HIV infection and glossary. London, UK: 2003 – 2004; Slides 1 – 35
28. Lightman S. Undergraduate medical lecture: Red eye. London, UK: 2003 – 2004; Slides 1 – 2
29. Lightman S. Undergraduate medical lecture. Giant cell arteritis. London, UK: 2003 – 2004; Slides 1 – 7
30. Lightman S. Undergraduate medical lecture. Behçet's disease. London, UK: 2003 – 2004; Slides 1 – 9

Additional Source of Teaching Material:

Metz JCM, Verbeek-Weel AMM, HJ H. Blueprint 2001: Training of doctors in The Netherlands. (Appendix list of skills, list of clinical pictures ophthalmology). English translation by David TE and JE Van de Wiel, A. Gorsira MLB; 2001: 53 – 56

XV. Ophthalmic Images by Anatomic Location and Diagnosis



For complete (non-abbreviated) reference information, refer to References, section XIV.

Cornea

- I. Lesions of corneal, superficial (actinic keratitis, erosion, contact lenses); Cornea, foreign bodies
 - A. Ophthalmic Images Collection, CD-ROM: L06
 - B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XIX-10, A-D cornea, foreign body; fig. XIX-11 corneal rust ring and multiple retained iron foreign bodies: 380, 382
- II. Burns: alkali
 - A. Ophthalmic Images Collection, CD-ROM: B14, B15
 - B. Sutphin JE et al. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XIX-1 mild alkali burn; fig. XIX-2 moderate alkali burn with edema and haze: 365 – 368
 - C. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 24 Diagnosis: alkali burn: 48
- III. Burns – acid; Burns – heat
 - A. Ophthalmic Images Collection, CD-ROM: B23

Keratitis

- I. Keratitis with corneal ulcer
 - A. Ophthalmic Images Collection, CD-ROM: B08
 - B. Flynn HW, Jr. Diabetes and Ocular Disease: Past, Present and Future. Ophthalmology Monographs 14; fig. 10-1 neurotrophic ulcer in patient with decreased corneal sensitivity: 223
- II. Dendritic keratitis (Herpes simplex)
 - A. Ophthalmic Images Collection, CD-ROM: B06
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 13 Diagnosis: ocular herpes simplex: 26
- III. Keratoconjunctivitis sicca
 - A. Ophthalmic Images Collection, CD-ROM: B05

- B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. V-6 keratoconjunctivitis sicca with punctuate epithelial erosions, shown by rose bengal stain; fig. VI-10 conjunctival xerosis with focal keratinization (Bitot's spot) as a result of vitamin A deficiency: 77 – 86
- IV. Corneal edema
 - A. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XIX-2 moderate alkali burn with corneal edema and haze: 366
- V. Corneal dystrophy
 - A. Ophthalmic Images Collection, CD-ROM: B16
 - B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and Cornea. fig. XV-12 Fuchs' endothelial dystrophy showing microcystic epithelial edema: 308
- VI. Keratoconus
 - A. Ophthalmic Images Collection, CD-ROM: B11 – 13
 - B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XV-16 keratoconus: 312

Conjunctiva

- I. Conjunctival, foreign body
 - A. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XIX-9 foreign bodies seen on the everted surface of the upper eyelid: 379
- II. Pterygium
 - A. Ophthalmic Images Collection, CD-ROM: B29, B30
 - B. Coleman AL. Eye Care Skills on CD-ROM. Managing of the red eye: slide 54, 55
- III. Subconjunctival hemorrhage
 - A. Ophthalmic Images Collection, CD-ROM: B38
 - B. Coleman AL. Eye Care Skills on CD-ROM. Managing of the red eye: slide 47
 - C. Bradford CA. Basic Ophthalmology: fig. 5.10
- IV. Neoplasm of the conjunctiva
 - A. Ophthalmic Images Collection, CD-ROM: B47, B48
 - B. Cunningham Jr., ET. HIV/AIDS and the Eye, A Global Perspective, Ophthalmology Monographs 15. 4-1 adnexal manifestations; fig. 4-6 squamous cell carcinoma of conjunctiva at superior limbus: 39

Sclera

- I. Nodular episcleritis; Diffuse anterior scleritis; Nodular scleritis
 - A. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. IX-19 nodular episcleritis; fig. IX-20 diffuse anterior scleritis; fig. IX-21 nodular scleritis: 222 – 224

Eyeball

- I. Eyeball, contusion; Eyeball, perforation
 - A. Ophthalmic Images Collection, CD-ROM: L22
 - B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XIX-13 rupture of globe secondary to blunt trauma: 387
- II. Eyeball, intraocular foreign body
 - A. Ophthalmic Images Collection, CD-ROM: L15
 - B. Regillo C. Basic and Clinical Science Course Section 12. Retina and vitreous: fig. 13-6.
- III. Endophthalmitis
 - A. Opremac ME, Basic and Clinical Sciences Course Section 9. Intraocular inflammation and uveitis. fig. 11-1 exogen-

ous postoperative endophthalmitis (bacterial); fig. 11-2 endogenous endophthalmitis (meningococcal meningitis): 207–209

IV. Microphthalmos

- A. Ophthalmic Images Collection, CD-ROM: H15
- B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XIII-2 severe microcornea and microphthalmos OD; both irides are colobomatous: 272

V. Buphthalmos

- A. Ophthalmic Images Collection, CD-ROM: C08
- B. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig. XXI-1 A. congenital glaucoma, right eye; B. right cornea larger and hazy; C. left cornea clear; D. late congenital glaucoma, left eye: 255

Anterior Chamber

I. Hyphema

- A. Ophthalmic Images Collection, CD-ROM: L11
- B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. XIX-6 total, or “eight-ball,” hyphema: 374–375
- C. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 16 Diagnosis: traumatic hyphema: 32

II. Hypopyon

- A. Cunningham Jr., ET. HIV/AIDS and the Eye, A Global Perspective, Ophthalmology Monographs 15, 5-4 Anterior Uveitis, fig. 5-7 Severe anterior uveitis with fibrin exudates and hypopyon and posterior synechiae formation in patient taking rifabutin: 50

Iris and Ciliary Body

I. Iridocyclitis, iritis

- A. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 10 Diagnosis: sarcoid uveitis: 20

II. Tumor of iris

- A. Grossniklaus HE. Basic and Clinical Sciences Course Section 4. Ophthalmic pathology and intraocular tumors. fig. XX-1 metastasis to the iris associated with hyphema; fig. XX-2 metastasis from breast carcinoma to the iris: 270

Glaucoma

I. Glaucoma, congenital

- A. Ophthalmic Images Collection, CD-ROM: H03, H04
- B. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig. XXI-1 A. congenital glaucoma, right eye; B. right cornea larger and hazy; C. left cornea clear; D. late congenital glaucoma, left eye: 255

II. Simple glaucoma

- A. Ophthalmic Images Collection, CD-ROM: C06, C11, C26
- B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 12, Diagnosis: primary open angle glaucoma: 24

III. Acute glaucoma

- A. Ophthalmic Images Collection, CD-ROM: C01, C05, C09
- B. Coleman AL. Eye Care Skills on CD-ROM. Managing of the red eye: slide 83–86

IV. Secondary glaucoma

- A. Ophthalmic Images Collection, CD-ROM: C10, C13, C18, C23, C24, C25

Lens

I. Cataract

- A. Ophthalmic Images Collection, CD-ROM: A01-07, A10
- B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 6, Diagnosis: cataract: 12
- C. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig. XXII-7 bilateral congenital cataracts: 271

II. Aphakia; pseudophakia

- A. Ophthalmic Images Collection, CD-ROM: A19–26
- B. Coleman AL. Eye Care Skills on CD-ROM. Eye care for the elderly: slide 54

III. Lens dislocation; Marfan's syndrome; homocystinuria

- A. Ophthalmic Images Collection, CD-ROM: H38
- B. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig. XXII-5 A and B superotemporal displacement of lenses, bilateral; C. inferonasal displacement, right eye; D. lens dislocation into vitreous, left eye: 269
- C. Rosenfeld SI. Basic and Clinical Sciences Course Section 11. Lens and cataract. fig. 4-15 Marfan's Syndrome A. arachnodactyly in a patient with Marfan's syndrome B. Subluxated lens in Marfan's syndrome: 41

Refraction and Accommodation

I. Hyperopia

- A. Ophthalmic Images Collection, CD-ROM: G25, G26, G29
- B. Miller KM. Basic and Clinical Sciences Course Section 3, Optics, refraction, and contact lenses. fig. 3-10 hyperopia with accommodation relaxed A,B: 117

II. Myopia

- A. Ophthalmic Images Collection, CD-ROM: G30, G31, G34
- B. Miller KM. Basic and Clinical Sciences Course Section 3. Optics, refraction, and contact lenses. fig. 4-18 a diverging lens is used to correct myopia: 144

III. Astigmatism

- A. Ophthalmic Images Collection, CD-ROM. 2002: V.3: G21, G22
- B. Weiss JS. Basic and Clinical Science Course Section 14, Refractive surgery. fig. 3-5: 48

IV. Cycloplegia; presbyopia

- A. Miller KM. Basic and Clinical Sciences Course Section 3. Optics, refraction, and contact lenses. Table 4-1 commonly used cycloplegic agents; Table 4-2 average accommodation amplitudes for different ages: 142, 149

Vision and Visual Fields

I. Amblyopia; diplopia; suppression

- A. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 22, Diagnosis: esotropia: 44

II. Hemianopia, bitemporal, and homonymous

- A. Ophthalmic Images Collection, CD-ROM: E26, E27
- B. Bradford CA. Basic Ophthalmology: fig. 7.12

Retina

- I. Retinal detachment
 - A. Ophthalmic Images Collection, CD-ROM: K70-72
 - B. Rosenfeld SI, Basic and Clinical Science Course Section 11. Lens and cataract. fig. 11-15; Retinal detachment with proliferative retinopathy: 270
- II. Retina, vessel occlusion or bleeding
 - A. Ophthalmic Images Collection, CD-ROM: K20, K34-K36
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 19, Diagnosis: central retinal artery occlusion; Case 21, Diagnosis: central retinal vein occlusion: 38, 42
- III. Degeneration of macula, age dependent
 - A. Ophthalmic Images Collection, CD-ROM: K03-K05
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 17, Diagnosis: age-related macular degeneration: 34
- IV. Retinoblastoma
 - A. Ophthalmic Images Collection, CD-ROM: H27-29
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 27, Diagnosis: leukocoria/retinoblastoma: 54
- V. Retinopathy of prematurity
 - A. Ophthalmic Images Collection, CD-ROM: H32-36
 - B. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. Table 24-1 International Classification of Acute Stages of Retinopathy of Prematurity; fig. XXIV-2 – XXIV-6 Stages of retinopathy of prematurity: 302,304
- VI. Retinopathy, diabetic
 - A. Ophthalmic Images Collection, CD-ROM: K14, K15, K40, K41
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 1, Diagnosis: nonproliferative diabetic retinopathy; Case 9, Diagnosis: proliferative diabetic retinopathy: 2, 18
- VII. Retinopathy, hypertensive
 - A. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 5, Diagnosis: hypertensive retinopathy: 10
- VIII. Retinitis
 - A. Ophthalmic Images Collection, CD-ROM: K29
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 25, Diagnosis: cytomegalovirus retinitis: 50

Choroid

- I. Chorioretinitis
 - A. Cunningham ET. HIV/AIDS and the Eye, A Global Perspective, Ophthalmology Monographs 15, fig. 6-5 Retinal Vein or Artery Occlusion, fig. 6-10 Pneumocystis carinii choroiditis: 67
- II. Neoplasms of the choroids
 - A. Ophthalmic Images Collection, CD-ROM: K25, K26
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 7, Diagnosis: malignant choroidal melanoma: 14

Vitreous

- I. Vitreous hemorrhage
 - A. Ophthalmic Images Collection, CD-ROM: K86
 - B. Regillo C. Basic and Clinical Science Course Section 12. Retina and vitreous. fig. 5-9 Neovascularization of the disc with small vitreous hemorrhage in proliferative diabetic retinopathy. (Standard photograph 10A, courtesy of DRS). Even without vitreous hemorrhage, this amount of NVD is the lower limit of moderate NVD, and is considered high-risk proliferative diabetic retinopathy: 110

Optic Disc and Optic Nerve

- I. Optic disc cupping
 - A. Ophthalmic Images Collection, CD-ROM: C54-57
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 12, Diagnosis: primary open angle glaucoma: 24
- II. Papilledema
 - A. Ophthalmic Images Collection, CD-ROM: E16, E17
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 14, Diagnosis: papilledema: 28
- III. Optic atrophy
 - A. Ophthalmic Images Collection, CD-ROM: C58
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 3, Diagnosis: optic atrophy: 6
- IV. Optic neuropathy; Optic neuritis
 - A. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 11, Diagnosis: anterior ischemic optic neuropathy: 22
 - B. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig. XXV-7 optic neuritis, left eye; normal right eye shown for comparison: 337

Eyelids

- I. Blepharitis
 - A. Ophthalmic Images Collection, CD-ROM: B49
 - B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 18, Diagnosis: blepharitis: 36
- II. Hordeolum
 - A. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 26, Diagnosis: traumatic hordeolum: 32
- III. Chalazion
 - A. Ophthalmic Images Collection, CD-ROM: H02, B43, B44
 - B. Sutphin JE. Basic and Clinical Sciences Course Section 8. External diseases and cornea. fig. V-5 chalazion: 71
- IV. Eyelid laceration
 - A. Ophthalmic Images Collection, CD-ROM: F34, F35
 - B. Coleman AL. Eye Care Skills on CD-ROM. Eye trauma and emergencies: slide 32, 33
- V. Entropion
 - A. Ophthalmic Images Collection, CD-ROM: F17
 - B. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XII-5 involutional entropion; fig. XII-8 Cicatricial entropion: 184,186
- VI. Ectropion
 - A. Ophthalmic Images Collection, CD-ROM: F14

- B. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XII-1 types of ectropion. A. involutinal. B. cicatricial: 177
- VII. Trichiasis; Blepharoplasty; Lagophthalmos
- A. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XII-13 bilateral symmetric congenital ptosis; fig. XII-21 lower eyelid retraction following blepharoplasty: 195, 214
- VIII. Epicanthus
- A. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XI-3 congenital eyelid deformities. C. epicanthus: 137
- B. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig. XVI-6 epicanthus, bilateral: 197
- IX. Ptosis
- A. Ophthalmic Images Collection, CD-ROM: F45, F47
- B. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XII-14 ptosis with levator aponeurosis dehiscence A,B,C: 197
- X. Lid Retraction
- A. Ophthalmic Images Collection, CD-ROM: F52
- B. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XII-8 thyroid eyelid retraction: 205
- C. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 4, Diagnosis: endocrine ophthalmopathy: 8
- XI. Xanthelasma
- A. Grossniklaus HE. Basic and Clinical Sciences Course Section 4. Ophthalmic pathology and intraocular tumors. fig. XIII-6 xanthelasma: 176
- XII. Eyelid tumor; basal cell carcinoma
- A. Ophthalmic Images Collection, CD-ROM: F02, F03
- B. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XI-18 basal cell carcinoma; fig. XI-19 morpheaform sclerosing basal cell carcinoma: 158
- C. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 20, Diagnosis: basal cell carcinoma: 40
- C. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig. XXI-5 orbital roof fracture in infant who fell with frontal impact. A. marked right upper eyelid swelling from hematoma originating in the superior orbit adjacent to a linear fracture. B. coronal CT image of a different patient, showing a bone fragment displaced into left orbit: 409
- III. Tumor of orbit
- A. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system fig. V-21, metastatic prostate cancer. fig. V-22a, Woman with enophthalmos and motility restriction secondary to metastatic breast carcinoma to the orbit: 95

Squint – Motility Disturbances

- I. Convergent strabismus; congenital esotropia
- A. Ophthalmic Images Collection, CD-ROM: H07, H08
- B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 22, Diagnosis: esotropia: 44
- II. Divergent strabismus; exotropia
- A. Ophthalmic Images Collection, CD-ROM: H09-12
- B. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig.VIII-2 A. ten-month-old infant with congenital exotropia also shows moderate motor developmental delay: 107
- III. Upward deviation strabismus; hypertropia
- A. Ophthalmic Images Collection, CD-ROM: E02
- B. Kline LB, Basic and Clinical Science Course Section 5. Neuro-ophthalmology. IV nerve palsy 9-13a,b,c: 238
- IV. Downward deviation strabismus; hypotropia
- A. Coleman AL. Eye Care Skills on CD-ROM. Eye trauma and emergencies: slide 29
- V. Latent strabismus; heterophoria. Strabismus, intermittent
- A. Simon JW. Basic and Clinical Sciences Course Section 6. Pediatric ophthalmology and strabismus. fig.VIII-1 A. three-year old boy with intermittent exotropia: 102
- VI. Strabismus, paralytic
- A. Ophthalmic Images Collection, CD-ROM: H19
- B. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 8, Diagnosis: third nerve palsy: 16

Lacrimal Apparatus

- I. Dacryoadenitis; Tumor of lacrimal gland
- A. Ophthalmic Images Collection, CD-ROM: F25-29
- B. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. V-18 A,B,C: 82
- II. Dacryocystitis; Dacryostenosis; Lacrimal duct, laceration
- A. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. XIV-11 acute dacryocystitis with cellulitis: 249

Orbit

- I. Inflammation of orbit, orbital cellulitis;
- A. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. IV-2 A. right orbital cellulitis with exotropia: 41
- II. Fracture of orbit
- A. Ophthalmic Images Collection, CD-ROM: F38-42
- B. Kerston RC. Basic and Clinical Sciences Course Section 7. Orbit, eyelids, and lacrimal system. fig. VI-5 blow out fracture with x-ray: 103

Issue of Knowledge, Other Than Clinical Pictures

- I. Eye disorders due to diabetes mellitus
- A. Ophthalmic Images Collection, CD-ROM: K14, K15
- B. Coleman AL. Eye Care Skills on CD-ROM. Diabetes and eye disease: slide 18 – 24, 34
- C. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 1, Diagnosis: nonproliferative diabetic retinopathy: 2
- II. Eye disorders due to hyperthyroidism; Graves' disease
- A. Ophthalmic Images Collection, CD-ROM: E19-21
- B. Coleman AL. Eye Care Skills on CD-ROM. Ocular manifestations of systemic Disease: slide 64 – 74
- C. Mannis MJ. Case Studies in Ophthalmology for Medical Students, Instructor Manual. Case 4, Diagnosis: endocrine ophthalmopathy: 8