

# ICO Residency Curriculum

## 2nd Edition and Updated Community Eye Health Section

The International Council of Ophthalmology (ICO) Residency Curriculum offers an international consensus on what residents in ophthalmology should be taught. While the ICO curriculum provides a standardized content outline for ophthalmic training, it has been designed to be revised and modified, with the precise local detail for implementation left to the region's educators.

Download the Curriculum from the ICO website: [icoph.org/curricula.html](http://icoph.org/curricula.html).



**INTERNATIONAL  
COUNCIL of  
OPHTHALMOLOGY**

[www.icoph.org](http://www.icoph.org)

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First edition 2006, second edition 2012, Community Eye Health Section updated 2016.

# International Council of Ophthalmology Residency Curriculum

## Introduction

### “Teaching the Teachers”

The International Council of Ophthalmology (ICO) is committed to leading efforts to improve ophthalmic education to meet the growing need for eye care worldwide.

To enhance educational programs and ensure best practices are available, the ICO focuses on "Teaching the Teachers," and offers curricula, conferences, courses, and resources to those involved in ophthalmic education. By providing ophthalmic educators with the tools to become better teachers, we will have better-trained ophthalmologists and professionals throughout the world, with the ultimate result being better patient care.

Launched in 2012, the ICO's Center for Ophthalmic Educators, [educators.icoph.org](http://educators.icoph.org), offers a broad array of educational tools, resources, and guidelines for teachers of residents, medical students, subspecialty fellows, practicing ophthalmologists, and allied eye care personnel.

The Center enables resources to be sorted by intended audience and guides ophthalmology teachers in the construction of web-based courses, development and use of assessment tools, and applying evidence-based strategies for enhancing adult learning. The interactive feature, “Connections,” is the Center's dynamic focal point, where ophthalmic educators can share ideas and collaborate with peers.

The Center builds on the ICO's original interactive online educational presence: World Ophthalmology Residency Development (WORD), which was developed in 2008 by Eduardo Mayorga, MD, ICO Director for E-Learning, and Gabriela Palis, MD, Editor-in-Chief, Center for Ophthalmic Educators.

### ICO Residency Curriculum

The ICO Residency Curriculum is one of the many vital online resources available at the Center for Ophthalmic Educators. Originally published in the journal *Klinische Monatsblätter für Augenheilkunde* in 2006, the ICO Residency Curriculum recently underwent a thorough revision under the leadership of Andrew G. Lee, MD, Chair. The updated Residency Curriculum offers an international consensus on what residents in ophthalmology should be taught. Sixteen global committees, divided by subspecialty and guided by individual subspecialty chairs, updated the existing guidelines and references, reinforcing essential cognitive and technical ophthalmic skills.

Changes include the addition of a new section, Community Eye Health. Refractive Surgery, previously a subset of Cornea, External Diseases, and Refractive Surgery, is now a stand-alone section. Like the 2006 curriculum, which outlined a broad-based curriculum, the learners' experience and expertise is stratified at Basic, Standard, and Advanced levels of ophthalmic training; but a new fourth level, “Very Advanced,” corresponding to a “subspecialist” or

“fellow” level of training, has been added. Within each training level “Must Know” items are identified by two asterisks (\*\*). These levels of standardization act as a foundation for developing clear and defined milestones and provide benchmarks to gauge progress and performance. (For a more detailed description of ICO Residency Curriculum revisions, please see the [Information for Educators](#).)

The 2006 curriculum was developed following thorough collection and analysis of ophthalmology residency and training programs worldwide. At that time, the ICO deliberately shifted from an “Apprenticeship System” format, where content might be contingent on the bias of trainers, to a curriculum-based system, providing an educational framework where goals, expectations, knowledge base, competencies, and technical training are carefully defined to initiate the training process.

### **Customizable Curriculum**

By being delivered online, the ICO Residency Curriculum is a “living document,” which allows for adaptation and translatability. While the ICO curriculum provides a standardized content outline for ophthalmic training, it has been designed to be revised and modified, with the precise local detail for implementation left to the region’s educators.

Adaptability is important because causes of blindness and reduced vision differ widely, and curricular components essential in one geographical locale may be less important in other regions. Similarly, economic and social developments vary globally, and treatments and techniques considered indispensable for one region might be unattainable or unimportant for others. Standards may need to be modified according to local priorities, goals, needs, culture, governmental policies, social systems, financial constraints, varying use of allied care personnel, and differing tangible resources.

The ICO’s goal is to create a curriculum of enduring value for widely different regions regardless of nationality, culture, medical market maturity or socioeconomic status.

### **Future Curricula Plans**

The ICO plans to use the addition of the “Very Advanced” level of training as a basis to next define curricula for the ophthalmologic subspecialties.

### **Other ICO Educational Programs**

The ICO acts to support ophthalmic education, advocate quality eye care, and advance scientific ophthalmology through support of ICO programs, which include:

- **World Ophthalmology Congress (WOC).** First held in Brussels in 1857, the WOC is the longest continuing international meeting in all of medicine
- **World Ophthalmology Education Colloquium.** Started in 2008, this series of six symposia and keynote talks held during the WOC engages educators in redefining the most effective ways to teach.
- **ICO International Examinations for Ophthalmologists.** The ICO Examinations promote the excellence of eye care worldwide by encouraging individuals to acquire and maintain the highest standard of practice of ophthalmology and are the only worldwide

medical specialty examinations

- **ICO International Fellowships and Helmerich Fellowships.** The ICO offers International Fellowships in duration of three months and one year. The International Fellowships were established to help young ophthalmologists from developing nations improve their practical skills and broaden their perspectives of ophthalmology. The Helmerich one-year fellowships offer advanced subspecialty training to ophthalmologists to help transmit new knowledge to the home country.
- **Education Committees and Task Forces.** The ICO has multinational committees and task forces focused on defining, disseminating and implementing curricula and guidelines involving educational programs for medical student education, residency training, directors of residency education, allied health personnel education, continuing medical education, subspecialty education, and emerging technologies for innovative ophthalmic education.
- **Program Directors and Trainers Courses.** The ICO sponsors courses on a local level that provide trainers with good practices from existing teaching models by sharing and modifying existing teaching tools and curricula materials.
- **Regional Conferences for Ophthalmic Educators.** The ICO organizes conferences for ophthalmic educators in collaboration with supranational and national societies. The Conferences cover modern educational theory, methods, and tools with interactive workshops and discussion groups.

Detailed information about these and other ICO educational programs are available on the ICO's website: [www.icoph.org](http://www.icoph.org) or at: [http://icoph.org/refocusing\\_education.html](http://icoph.org/refocusing_education.html).

## **In Appreciation**

The ICO gratefully acknowledges the efforts of the many individuals who contributed to the development of the ICO Residency Curriculum. We thank Andrew G. Lee, MD, for chairing this undertaking; the chairs and members of the sixteen international committees for their vital contributions to this work; and the reviewers of the curriculum for their welcome expertise. (To see a complete list of committee chairs, members, and reviewers, please refer to the [Appendix](#).)

We also recognize and are indebted to the original 2006 International Task Force on Resident and Specialist Education in Ophthalmology. To see a complete list of 2006 task force members, please go to: <http://icocurriculum.blogspot.com/2011/09/acknowledgement-of-contributions-to.html>.

Finally, we would like to acknowledge the editorial efforts of the following individuals in making this work possible:

- Kathleen Miller, ICO Executive Director
- Christine Graham, ICO Education Coordinator
- Tina-Marie Gauthier, Medical Editor

Sincerely,

Bruce Spivey, ICO President

Mark O.M. Tso, MD, DSc, ICO Director for Education, 2000-2012

## Information for Educators

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### A. Purpose

The International Council of Ophthalmology (ICO) Residency Curriculum provides essential intellectual and clinical information (ie, cognitive and technical/surgical skills) that are necessary for an ophthalmologist. The curriculum is a content outline for a fund of knowledge. It is not designed to be all-inclusive but rather a guideline for the training of ophthalmic specialists.

The ICO recognizes that not all techniques of diagnosis and therapy presented in the curriculum are universally available, but they should serve as aspirational guidelines towards achieving modern methods of diagnosis and care of common eye problems.

As an international body, the ICO’s intent is to provide content useful for ophthalmology residents, fellows, and subspecialty experts working anywhere in the world. While the Residency Curriculum provides a standardized content outline for ophthalmic training, by being delivered online, it becomes a “living document,” a customizable curriculum allowing for adaptation and translatability with the precise local detail for implementation left to each region’s educators. Educators are encouraged to modify and apply the content as deemed appropriate to meet local, regional, and national priorities.

The Residency Curriculum is available for download from the ICO at:

[http://icoph.org/refocusing\\_education/curricula.html](http://icoph.org/refocusing_education/curricula.html). We hope you will enjoy reading, and more importantly, using, the curriculum in your teaching and assessing of ophthalmic knowledge and skills. Online comments and recommendations for future updates are actively encouraged and solicited through: <http://icocurriculum.blogspot.com>.

We thank [the subspecialty committee chairs and members](#) for their focused effort, and we also thank ophthalmic educators and leaders for their prior and anticipated contributions to the ICO Residency Curriculum, which ideally will serve to improve ophthalmic education worldwide.

Sincerely,

Andrew G. Lee, MD  
Chair, Residency Curriculum  
Email: [aglee@tmhs.org](mailto:aglee@tmhs.org)

## **B. Update of ICO Residency Curriculum**

The Residency Curriculum was initially published in 2006, under the title “Principles and Guidelines of a Curriculum for Education of the Ophthalmic Specialist.” The updated Residency Curriculum includes the modifications:

### **Sections**

- All sections and references from the 2006 curriculum have been updated.
- Community Eye Health has been added as a new section.
- Optics and Refraction, previously listed as two separate sections, have been combined into one section.
- Refractive Surgery, previously a subset of Cornea, External Diseases, and Refractive Surgery, is now a stand-alone section.
- Uveitis is now called Uveitis and Ocular Inflammation.
- Ophthalmic Practice and Ethics is now called Ethics and Professionalism in Ophthalmology.
- The term “Task Force” has been replaced with the term “Committee.”
- The Preface is now called Introduction.
- The Preamble is now called Information for Educators.

### **Stratification**

- The updated Residency Curriculum builds upon the Basic, Standard, and Advanced levels of training by incorporating a new fourth level, “Very Advanced,” which corresponds to a “subspecialist” or “fellowship” level of training.
- The terms post-graduate year (PGY) 2, 3, and 4 have been replaced with Year 1, Year 2, and Year 3 respectively.

### **Must Know**

- The updated Residency Curriculum prioritizes and identifies cognitive and technical skills the learner “Must Know” at each level. Within each section “Must Know” content is identified by two asterisks (\*\*).

## **C. Subspecialty Sections**

The Residency Curriculum consists of the following subspecialty sections:

- I. [Optics and Refraction](#)
- II. [Cataract and Lens](#)
- III. [Contact Lenses](#)
- IV. [Cornea and External Diseases](#)
- V. [Refractive Surgery](#)
- VI. [Glaucoma](#)
- VII. [Neuro-Ophthalmology](#)
- VIII. [Ophthalmic Pathology](#)
- IX. [Oculoplastic Surgery and Orbit](#)
- X. [Pediatric Ophthalmology and Strabismus](#)
- XI. [Vitreoretinal Diseases](#)

- XII. [Uveitis and Ocular Inflammation](#)
- XIII. [Ocular Oncology](#)
- IV. [Low Vision Rehabilitation](#)
- XV. [Ethics and Professionalism in Ophthalmology](#)
- XVI. [Community Eye Health](#)
- XVII. [Appendix](#)
  - [Chair, Section Chairs, and Committee Members](#)
  - [Section Reviewers](#)
  - [References](#)

#### **D. Definition of an Ophthalmologist**

An ophthalmologist is a doctor of medicine or doctor of osteopathy (DO, MD, or equivalent degree) who specializes in the eye and visual system. As a licensed medical doctor, the ophthalmologist's ethical and legal responsibilities include the care of individuals and populations suffering from diseases of the eye and visual system.

Specialist training is designed to provide a structured learning program facilitating the acquisition of core competencies as well as specialized cognitive and technical skills at a level appropriate for an ophthalmic specialist who has been fully prepared to begin their career as an independent consultant in ophthalmology.

#### **E. Stratification of Levels**

- Basic Level Goals = Year 1
- Standard Level Goals = Year 2
- Advanced Level Goals = Year 3
- Very Advanced Level Goals = Subspecialist

The curriculum is intended to be adaptable and flexible, depending upon the needs of the region. While stratifying the curricula by level (ie, Basic, Standard, Advanced, and Very Advanced) is somewhat artificial, it defines clear milestones for learners to progress up the ladder of expertise acquisition.

Differentiating various proficiency levels allows local customization of expectation based upon local resources, ability, and geography. For example, in some locations clinical needs are urgent, and marked abbreviations of the training program will be necessary to provide the region with sufficient numbers of practitioners.

#### **Years 1, 2, 3, and Subspecialist**

- Though Years 1, 2, 3, and Subspecialist correspond with Basic, Standard, Advanced, and Very Advanced Level Goals respectively, the listing of years are for clarification purposes only and not as a recommendation for duration of training, which is subject to local requirements and regulations.

#### **Very Advanced: Subspecialist Level of Training**

- The Very Advanced level has been included to provide a comparison to the three other levels of training (ie, Basic, Standard, Advanced).

- The Very Advanced level represents postresidency acquisition of additional skills and knowledge (eg, fellowship training).
- Individuals who reach the Very Advanced: Subspecialist level of training are expected to have accomplished the goals of the Basic, Standard, and Advanced levels of the curriculum.
- The Very Advanced level is NOT meant to be considered part of the residency-training program but certainly is an aspirational target.

## **F. Prioritization of Content: “Must Know”**

- The updated Residency Curriculum prioritizes and identifies cognitive and technical skills the learner “Must Know” at each level. “Must Know” content is identified by two asterisks (\*\*).
- “Must Know” is the minimum baseline—the lowest expectation—for all levels and all guidelines regardless of regional resources; it is not an ideal or aspirational target.
- “Must Know” content is recommended by the ICO and is defined as the minimum competency for a resident at that level.
- This curriculum does not use aspirational targets such as “should know” or “nice to know,” as they are variable based on region and become especially challenging to define. While “should know” is relevant and important, content defined as “should know” might be resource dependent or otherwise have some reason for not being learned or taught (eg, we do not see that disease in our particular country).

## **G. Drafting of Sections and Review Process**

### **Drafting of Sections**

- Each committee (referred to by the term “Task Force” in the 2006 curricula) was responsible for updating their section of the curriculum.
- Each committee was asked to identify the cognitive and technical skills in their subspecialty section deemed “Must Know,” which is identified by two asterisks (\*\*) within each section.
- Each committee was responsible for developing a fourth level of the curriculum, “Very Advanced,” outlining specific cognitive and technical skills for the “subspecialist.” The Very Advanced level allows direct comparison of residency (ie, Basic, Standard, and Advanced) guidelines and postresidency (ie, Very Advanced) guidelines.
- Committee members were asked to review relevant content in other curriculum sections to ensure consistency. If inconsistencies were found, that committee was asked to communicate with the chair or chairs of the relevant sections in order to resolve any discrepancies.

### **Review Process**

- Committee members were asked to identify at least five external colleagues to review their completed draft section.



- Reviewers were selected who were thought to be responsive, proficient in the English language, and most importantly, representative of the geographic and global coverage intended for the curriculum development process.
- Reviewers were asked to review the draft sections for accuracy, adaptability, and regional relevance.
- The document was presented in draft format for comment online January-April 2012 for public comment from ophthalmic educators worldwide.
- After all relevant changes were incorporated, sections were then edited for consistency and clarity by a medical editor.

#### **Committee Chairs, Members, and Section Reviewers**

- For a complete list of committee chairs and members, please see the [Appendix](#).
- For a complete list of reviewers, please see the [Appendix](#).

### **H. Customizable Curriculum**

- The Residency Curriculum is downloadable as a PDF and Word document, as well as a Google Doc for online access.
- The ICO Residency Curriculum provides a standardized content outline for ophthalmic training, but by being delivered online, it becomes a “living document,” a customizable curriculum allowing for adaptation and translatability with the precise local detail for implementation left to each region’s educators.
- Educators are encouraged to modify and apply the content as deemed appropriate to meet local, regional, and national priorities.
- Inclusion of therapies and investigations in the ICO Residency Curriculum does not imply that listings are all inclusive or that methods are endorsed by the ICO. Appropriate levels of expertise and knowledge should be achieved based on the care provided. Practitioners should know of therapies and investigations not available at their hospital or clinic, so that they can advise patients who may be able to seek care elsewhere.

### **I. Future Updates**

- Ophthalmic curricula worldwide will be improved through the valuable contributions and involvement of global leaders and educators.
- For consideration towards future updates of the Residency Curriculum, ophthalmic leaders and educators are invited to provide online comments and recommendations at [icocurriculum.blogspot.com](http://icocurriculum.blogspot.com).

### **J. Core Competencies**

Generic core "competencies" are expected of ophthalmic specialists, as promulgated by the United States Accreditation Council for Graduate Medical Education (ACGME). There are worldwide differences in nomenclature for the general competencies, and the United States version is presented for clarification purposes only. Local customs, practices, resources, and regulatory environments will dictate the application of these competencies for individual programs. The ACGME website is [www.acgme.org](http://www.acgme.org).

Core competencies include:

- Patient Care
- Medical Knowledge
- Practice-based Learning and Improvement
- Communication Skills
- Professionalism
- Systems-based Practice

Ophthalmic specialists are expected to:

### **Patient Care**

- Provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health;
- Communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families, taking into consideration patient age, gender identification, impairments, ethnic group, and faith community;
- Gather essential and accurate information about patients;
- Make informed decisions about diagnostic and therapeutic interventions, based on patient information and preferences, up-to-date scientific evidence, and clinical judgment;
- Develop and carry out patient management plans;
- Counsel and educate patients and their families;
- Use information technology to support patient-care decisions and patient education;
- Competently perform the medical and invasive procedures considered essential for the area of practice;
- Provide health care services aimed at preventing health problems or maintaining health; and
- Work with healthcare professionals, including those from other disciplines, to provide patient-focused care.

### **Medical Knowledge**

- Demonstrate knowledge about established and evolving biomedical, clinical, and cognate (eg, epidemiological and social-behavioral) sciences and apply this knowledge to patient care;
- Demonstrate an investigatory and analytic thinking approach to clinical situations; and
- Know and apply the basic and clinically supportive sciences, which are appropriate to ophthalmology.

### **Practice-based Learning and Improvement**

- Investigate and evaluate patient care practices; appraise and assimilate scientific evidence; and improve patient care practices;
- Analyze practice experience and perform practice-based improvement activities using a systematic methodology;

- Locate, appraise, and assimilate evidence from scientific studies related to patient health problems;
- Obtain and use information about regional patient population and the larger population from which patients are drawn;
- Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness; and
- Use information technology to manage information, access online medical information, support ongoing personal professional development; and facilitate the learning of students and other healthcare professionals.

### **Communications Skills**

- Demonstrate communication skills that result in effective information exchange and teaming with patients, patient families, and professional associates;
- Create and sustain a therapeutic and ethically sound relationship with patients;
- Use effective listening skills and elicit and provide information using effective nonverbal, explanatory, questioning, and writing skills; and
- Work effectively with others as a member or a leader of a health care team or other professional group.

### **Professionalism**

- Demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population;
- Demonstrate respect, compassion, and integrity;
- Demonstrate a responsiveness to the needs of patients and society that supersedes self-interest; accountability to patients, society, and the profession; and a commitment to excellence and on-going professional development;
- Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent, and business practices; and
- Demonstrate sensitivity and responsiveness to patient culture, age, gender identification, and disabilities.

### **Systems-based Practice**

- Demonstrate an awareness of and responsiveness to the larger context and system of health care and effectively call on system resources to provide care that is of optimal value;
- Understand how patient care and other professional practices affect other health care professionals, the health care organization, and the larger society, and how these system elements affect their personal ophthalmic practice;
- Know how types of medical practice and delivery systems differ from one another, including methods of controlling health care costs and allocating resources; and practice cost-effective health care and resource allocation that do not compromise quality of care;
- Advocate for high quality patient care and assist patients in dealing with system complexities; and

- Know how to partner with health care managers and health care providers to assess, coordinate, and improve health care, and know how these activities can affect system performance.
- Know how to partner with services that can improve quality of life (eg, health, education, livelihoods, social inclusion) of people with long term visual impairment.

Professional attitudes and conduct require that ophthalmic specialists must also have developed a style of care that is:

- Humane (eg, compassion in providing bad news, management of the visually impaired, and recognition of the impact of visual impairment on the patient and society);
- Reflective (eg, recognition of the limits of knowledge, skills, and understanding);
- Ethical;
- Integrative (eg, involvement in an interdisciplinary team for the eye care of children, patients with long term visual impairment or other disabilities, the systemically ill, the elderly, and with consideration of gender dimensions); and
- Scientific (eg, critical appraisal of the scientific literature, evidence-based practice, and use of information technology and statistics).

# **I. Optics and Refraction**

*The general educational objectives are to understand the principles, concepts, instruments, and methods of ophthalmology-related optics and refraction; and to apply these to clinical practice.*

## **Basic Level Goals: Year 1**

### **A. Cognitive Skills**

#### **Physical Optics**

1. Describe the wave and particle nature of light.
2. Explain the phenomenon of diffraction.
3. Explain the concepts of interference and coherence.
4. Define optical resolution.
5. Explain polarization.
6. Explain light scattering.
7. Define and compare transmission and absorption.
8. Explain photometry.
9. Define illumination.
10. Describe image quality.
11. Differentiate brightness and radiance.
12. Define refractive index.

#### **Geometric Optics**

##### ***Reflection (Mirrors)***

1. List the laws of reflection.
2. Explain images and objects as light sources.
3. Define refractive index.

##### ***Refraction***

1. Explain the law of refraction (Snell law), including:
  - a. Passage of light from one medium to another
  - b. Absolute index of refraction
  - c. Total internal reflection
2. Explain critical angle and total internal reflection.

##### ***Prisms***

1. Define a prism.\*\*
2. Explain the notation of prisms (eg, prism diopters).\*\*
3. Describe the use of prisms in ophthalmology (ie, diagnostic and therapeutic).\*\*
4. Explain Prentice rule.
5. Describe Fresnel and similar prisms.
6. Explain the concept of thin prisms.
7. Explain the prismatic effect of lenses.\*\*
8. Define spherical decentration and prism power.

##### ***Spherical Lenses***

1. Define a spherical lens.\*\*
2. Describe the cardinal points.
3. Recite the thin lens and thick lens formulas.

4. Define vergence of light, including diopter, convergence, divergence, and vergence formula.
5. Define the terms concave and convex.\*\*
6. Define the term magnification, including linear, angular, relative size, and electronic.

### ***Astigmatic Lenses***

1. Describe cylindrical lenses, including:\*\*
  - a. Spherocylinder lenses and surfaces\*\*
  - b. Cross cylinders (eg, Jackson cross cylinder)\*\*
2. Describe toric lenses.

### **Clinical Optics**

1. Define emmetropia.\*\*
2. Define ametropia.\*\*
3. Define myopia.\*\*
4. Define hypermetropia (hyperopia).\*\*
5. Define astigmatism.\*\*
6. Define anisometropia.\*\*
7. Define aniseikonia (including Knapp rule).\*\*
8. Define aphakia.\*\*
9. Explain optical parameters affecting retinal image size.
10. Describe the pupillary response and its effect on the resolution of the optical system (Stiles-Crawford effect).
11. Define visual acuity, including:\*\*
  - a. Distance and near acuity measurement
  - b. Minimal acuity (ie, visible, perceptible, separable, legible)
  - c. Visual acuity charts
12. Describe higher-order aberrations of the eye.
13. Explain how accommodation is affected by age.\*\*
14. Explain how the pinhole effect impacts visual acuity.\*\*
15. Explain accommodative problems.\*\*
16. Describe convergence or accommodative insufficiency or excess.
17. Define accommodative-convergence over accommodation (AC/A) ratio.
18. Describe the epidemiology of refractive errors, including:\*\*
  - a. Prevalence
  - b. Inheritance
  - c. Changes with age
  - d. Surgical considerations
19. Describe the potential problems with aphakic spectacles.\*\*
20. Describe the effect of spectacles and contact lens correction on accommodation and convergence (ie, amplitude, near point, far point).\*\*
21. Explain the principles of contrast sensitivity measurements.
22. Describe the correction of ametropia, including:\*\*
  - a. General principles\*\*
  - b. Spectacle lenses\*\*
  - c. Contact lenses\*\*
  - d. Intraocular lenses

- e. Principles of refractive surgery\*\*

### **Clinical Refraction**

#### ***Objective Refraction: Retinoscopy***

1. List the principles and indications for retinoscopy.\*\*

#### ***Subjective Refraction Techniques\*\****

1. Describe the major types of refractive errors.
2. Describe the indications for and use of trial lenses for simple refractive error.

#### ***Cycloplegic Refraction\*\****

1. Describe medication concentrations according to age (eg, cyclopentolate, atropine).

### **B. Technical/Surgical Skills**

#### **Geometric Optics**

##### ***Reflection (Mirrors)***

1. Illustrate reflection at a plane surface (ie, image and field of a plane mirror).\*\*
2. Illustrate reflection at curved surfaces (ie, focal point and focal length of a spherical mirror).\*\*
3. Demonstrate a multiple lens system.

##### ***Refraction***

1. Illustrate refraction at a plane surface.\*\*
2. Illustrate refraction at curved surfaces.\*\*
3. Demonstrate image jump and displacement.

##### ***Prisms***

1. Demonstrate the types of prisms (eg, plane, parallel, plate).
2. Illustrate refraction of light through a prism.

##### ***Spherical Lenses***

1. Draw out the formation of the image.\*\*
2. Demonstrate binocular balancing.

##### ***Astigmatic Lenses***

1. Demonstrate how the Maddox rod works.\*\*
2. Locate the conoid of Sturm.

##### ***Notation of Lenses***

1. Design myopic, hyperopic, and astigmatic lenses.\*\*
2. Perform simple transposition.\*\*
3. Perform toric transposition.
4. Calculate a lens prescription.\*\*

##### ***Aberration of Lenses***

1. Correct aberrations relevant to the eye, including spherical, coma, astigmatism, and distortion.
2. Describe color aberrations and perform the duochrome test.

### **Clinical Optics**

1. Illustrate optics of the eye, including the dioptric power of different structures.
2. Draw a schematic eye and reduced eye.
3. Demonstrate contrast sensitivity measurements.
4. Demonstrate the calculation of intraocular lens power.

## **Clinical Refraction**

### ***Objective Refraction: Retinoscopy***

1. Perform the technique of retinoscopy.\*\*
2. Perform an integrated refraction based upon retinoscopic results.\*\*
3. Identify media opacities with retinoscopy.
4. Perform cycloplegia.\*\*
5. Prescribe refractive correction based on the obtained objective and subjective measurements.\*\*

### ***Subjective Refraction Techniques\*\****

1. Perform elementary refraction techniques for myopia, hyperopia, and near-vision add.
2. Perform techniques for the correction for presbyopia (ie, measuring for near adds).

## **Instruments and Tests**

1. Demonstrate the use of the direct ophthalmoscope.\*\*
2. Demonstrate the use of the indirect ophthalmoscope.\*\*
3. Demonstrate the use of the retinoscope.\*\*
4. Demonstrate glare and contrast sensitivity testing.\*\*
5. Demonstrate the use of the automated refractor.
6. Demonstrate measurement of higher-order aberrations.
7. Demonstrate the use of stereoacuity testing.
8. Demonstrate the use of corneal topography (eg, placido disc, keratometer, automated corneal topography).\*\*
9. Demonstrate the use of the Hess screen or describe its use if not available.
10. Demonstrate the use of the synoptophore.
11. Demonstrate the use of color vision tests (eg, Ishihara color plates; Hardy-Rand-Rittler test, Farnsworth-Munsell test).

## **Standard Level Goals: Year 2**

### **A. Cognitive Skills**

#### **Optics**

##### ***Spectacles***

1. Describe materials index.
2. Describe the principles underlying progressive spectacle lens design.
3. Describe progressive lenses measurements.\*\*
4. Describe spectacles specificities in children.\*\*

##### ***Lasers***

1. Describe the technology behind the excimer laser and the femtosecond laser.
2. List different wavelengths used in ophthalmic lasers.
3. Describe indications for refractive surgery.\*\*

##### ***Aberrometry Technology***

1. Explain the principles underlying Hartmann-Shack aberrometers.
2. Describe the concept of Zernicke polynomials.

##### ***Diagnostic Equipment***

1. List indications for and the use of intraocular lens (IOL) calculation algorithms.\*\*



2. List indications for the use of corneal pachymetry.\*\*
3. List indications for the use of specular microscopy.\*\*
4. List indications for the use of corneal tomography with anterior segment optical coherence tomography (OCT).\*\*
5. List indications for the use of topographic/elevation corneal evaluation (ie, Pentacam, Orbscan II, Galilei).\*\*
6. List indications for the use of accommodometer.
7. List indications for the use of laser interferometry for macular testing.\*\*

**Refraction\*\***

1. Describe and prescribe more complex types of refractive errors, including postoperative refractive errors.
2. Describe the more advanced ophthalmic optics and optical principles of refraction and retinoscopy (eg, postkeratoplasty, post-cataract extraction).
3. Describe how to test muscle balance.

B. Technical Skills

**Optics**

***Aberrometry Technology***

1. Estimate the clinical incidence of higher-order aberrations.

***Diagnostic Equipment***

1. Demonstrate the use of IOL calculation algorithms.
2. Demonstrate the use of corneal pachymetry.
3. Demonstrate the use of specular microscopy.
4. Demonstrate the use of corneal tomography with anterior segment optical coherence tomography (OCT).
5. Demonstrate the use of topographic/elevation corneal evaluation (ie, Pentacam, Orbscan II, Galilei).
6. Demonstrate the use of accommodometer.
7. Demonstrate the use of laser interferometry for macular testing.

**Refraction\*\***

1. Perform more advanced refraction techniques (eg, astigmatism, complex refractions, asymmetric accommodative add).
2. Perform objective and subjective refraction techniques for more complex refractive errors, including astigmatism, irregular astigmatism (eg, keratoconus, keratectasia, post-corneal graft), and postoperative refractive error.
3. Measure the accommodative power.
4. Demonstrate the measurement of interpupillary distance (IPD).
5. Demonstrate the prescribing of multifocal lenses.
6. Demonstrate the prescribing of lenses for children.

**Advanced Level Goals: Year 3**

A. Cognitive Skills

1. Describe binocular balance.

2. Describe how to use more advanced techniques using trial lenses or the phoropter for more complex refractive errors, including modification and refinement of subjective manifest refractive error and more complex refractive errors (eg, advanced and irregular astigmatism, vertex distance).

B. Technical Skills

1. Evaluate binocular balance.
2. Demonstrate more advanced techniques using trial lenses or the phoropter for more complex refractive errors, including modification and refinement of subjective manifest refractive error and more complex refractive errors (eg, advanced and irregular astigmatism, vertex distance).

### **Very Advanced Level Goals: Subspecialist**

A. Cognitive Skills

**Low Vision Aid Prescribing**

1. Describe the principles of low vision aids (eg, magnification, increasing contrast, learning to use functioning areas of the eye).
2. Describe cases where telescopic aids (eg, Galilean telescope, Keplerian telescope) can be of use.

B. Technical Skills

**Low Vision Aid Prescribing**

1. Grade high reading addition.
2. Calculate and prescribe magnifying lenses.

**Other**

1. Perform objective and subjective refraction techniques in the most complex refractive error, including astigmatism and postoperative refractive error.
2. Perform the most advanced techniques using trial lenses or the phoropter for more complex refractive errors, including modification and refinement of subjective manifest refractive error, cycloplegic retinoscopy and refraction, and post-cycloplegic refraction, irregular astigmatism, postkeratoplasty, and refractive surgery cases.
3. Use the keratometer for detection of subtle or complex advanced refractive error.
4. Use more advanced refraction instruments and techniques (eg, distometer, automated refractor, automated corneal topography).
5. Measure and evaluate peripheral refraction and accommodative lag.
6. Calculate and prescribe prisms for diplopia.
7. Demonstrate calculation of IOLs within the normal range of ametropias.
8. Demonstrate calculation of IOLs in children.
9. Demonstrate calculation of IOLs in highly myopic patients.
10. Demonstrate calculation of IOLs for irregular corneas (ie, keratoconus).
11. Demonstrate calculation of IOLs after corneal refractive surgery.

\* \* \*

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## II. Cataract and Lens

### General Educational Objectives

1. Describe the diagnosis, evaluation, and management of intraoperative and postoperative complications of cataract and intraocular lens (IOL) surgery, including planned extracapsular extraction (ECCE) and phacoemulsification.\*\*
2. Perform the complete preoperative ophthalmologic examination of cataract patients, including the consent for the procedure.\*\*
3. Formulate the differential diagnoses for cataract and related lens conditions.\*\*
4. Perform routine and advanced cataract surgery with IOL placement.\*\*
5. Perform the complete postoperative examinations following cataract surgery, including refraction.\*\*
6. Manage intraoperative and postoperative complications of cataract surgery.\*\*
7. Develop and exercise clinical and ethical decision making in cataract patients.\*\*
8. Develop good patient communication techniques regarding cataract surgery.\*\*
9. Work effectively as a member of the medical care team.\*\*
10. Develop teaching skills about cataract for instructing junior trainees and students.\*\*

### Basic Level Goals: Year 1

#### A. Cognitive Skills

1. Describe the lens anatomy, physiology, and accommodation.\*\*
2. Identify the most common causes and types of cataract (eg, anterior polar, cortical, nuclear sclerotic, posterior subcapsular, posterior polar, mature lenses such as the Morgagnian cataract).\*\*
3. Describe the relationship between the lens and systemic disease (eg, diabetes, myotonic dystrophy).\*\*
4. List ocular conditions that are associated with cataract (eg, uveitis, Wilson disease, ocular ischemia, ocular tumors, including treatment for tumors such as radiotherapy).\*\*
5. List systemic and topical medicine that can cause pathologic changes in the lens (eg, oral and topical corticosteroid use).\*\*
6. List the basic history and examination steps for preoperative cataract and posterior capsular opacification evaluation.\*\*
7. Identify and describe the principles and mechanisms of the following instruments in the evaluation of cataract:
  - a. Lensometer\*\*
  - b. Autorefractor\*\*
  - c. Retinoscope\*\*
  - d. Phoropter or loose lenses\*\*
  - e. Keratometer\*\*
  - f. Slit-lamp biomicroscope\*\*
  - g. Glare and contrast testing devices\*\*
  - h. Potential acuity meter \*\*
8. Describe the basics of IOL power estimation, including:
  - a. Linear regression formulas (eg, Sanders-Retzlaff-Kraff [SRK] and SRKII)\*\*

- b. Theoretical eye model prediction formulas (eg, SRKT, Holladay, and Haigis)\*\*
  - 9. Describe the methods to estimate axial eye length, including:
    - a. Contact ultrasound\*\*
    - b. Immersion ultrasound\*\*
    - c. IOLMaster, LENSTAR, or equivalent, even if equipment is unavailable\*\*
  - 10. List the steps of routine intracapsular cataract extraction (ICCE), ECCE, and phacoemulsification.\*\*
  - 11. Define the elementary refraction techniques to obtain best-corrected vision prior to considering cataract extraction.\*\*
  - 12. Describe the major etiologies of dislocated or subluxated lens (eg, pseudoexfoliation syndrome, trauma, Marfan syndrome, homocystinuria, Weill-Marchesani syndrome, syphilis).\*\*
  - 13. Describe the following:
    - a. Basic ophthalmic optics as related to cataract\*\*
    - b. Types of refractive error in cataract\*\*
    - c. Retinoscopy techniques for cataract\*\*
    - d. Subjective refraction techniques for cataract patients\*\*
  - 14. Describe methods to decrease postoperative infection, including presurgical preparation, intraoperative antibiotics, and postoperative antibiotic techniques.
  - 15. Describe postoperative medications used for cataract surgery, including antibiotics, nonsteroidal anti-inflammatory drugs, and corticosteroid therapy.
  - 16. Describe the risk factors for intraoperative floppy iris syndrome (IFIS) and intraoperative techniques to limit the risk of this syndrome (eg, alpha blockers, use of rings, hooks)
  - 17. Describe the special considerations when dealing with a unilateral cataract (trauma, history of uveitis, history of topical steroid use, past surgeries)
- B. Technical/Surgical Skills
- 1. Perform basic slit-lamp biomicroscopy, retinoscopy, and ophthalmoscopy.\*\*
  - 2. Evaluate and classify common types of lens opacities.\*\*
  - 3. Perform subjective refraction techniques and retinoscopy in patients with cataract.\*\*
  - 4. Perform and document laser capsulotomy on routine cases of posterior capsule opacification.\*\*
  - 5. Perform direct and indirect ophthalmoscopy prior to and following cataract surgery.\*\*
  - 6. Perform the basic steps of cataract surgery (eg, incision, wound closure) in the practice lab, if available.\*\*
  - 7. Assist with cataract surgery and perform patient preparation, sterile draping, and anesthesia.\*\*
  - 8. Implement the basic preparatory procedures for cataract surgery (eg, obtaining informed consent, identification of instruments, sterile technique, gloving and gowning, prep and drape, and other preoperative preparation).\*\*
  - 9. Use the operating microscope for basic cataract surgery.\*\*
  - 10. Perform some of the steps of cataract surgery under direct supervision, including any or all of the following:
    - a. Wound construction\*\*
    - b. Anterior capsulotomy/capsulorhexis\*\*
    - c. Instillation and removal of viscoelastics\*\*
    - d. Hydrodissection and hydrodelineation\*\*

- e. Extracapsular and phacoemulsification techniques\*\*
- f. Irrigation and aspiration\*\*
- g. Cortical cleanup\*\*
- h. IOL implantation (eg, anterior and posterior) \*\*
- i. Removal of viscoelastic\*\*
- j. Suturing of the wound\*\*
- k. Wound hydration\*\*

## **Standard Level Goals: Year 2**

### A. Cognitive Skills

1. Describe the less common causes of lens abnormalities (eg, spherophakia, lenticonus, ectopia lentis, coloboma).\*\*
2. Describe the preoperative evaluation of the cataract patient, including:
  - a. Systemic diseases of interest or relevance to cataract surgery\*\*
  - b. Systemic medication of relevance to cataract surgery (eg, alpha 1 adrenergic blocking agent, blood thinning agents, corticosteroids)\*\*
  - c. Relationship of external and corneal diseases of relevance to cataract and cataract surgery (eg, lid abnormalities, dry eye)\*\*
  - d. Management of uveitis prior to and following cataract surgery\*\*
  - e. Management of glaucoma prior to and following cataract surgery, including options for postoperative intraocular pressure (IOP) control\*\*
3. Describe glare analysis testing for cataract surgery.\*\*
4. Describe the use of A-scan and B-scan contact and immersion ultrasonography and optical coherence techniques in cataract surgery to measure axial eye length.\*\*
5. Describe the instruments and techniques of cataract extraction, including extracapsular surgery and phacoemulsification.\*\*
6. Describe the important parameters of the phacoemulsification machine and how to alter them for particular conditions of surgery.\*\*
7. Describe the types, indications, and techniques of anesthesia for cataract surgery (eg, topical,\*\* local,\*\* general).
8. Describe indications, techniques, and complications of surgical procedures, including: ECCE, ICCE, phacoemulsification, paracentesis, and IOL placement.\*\*
9. Describe the pathogenesis and strategies for prevention of posterior capsular opacification.\*\*
10. Describe history and techniques of basic IOL implantation.
11. Correlate the level of visual acuity with the lens or capsular opacities.\*\*
12. Describe the pathogenesis, clinical presentation, differential diagnosis, evaluation, clinical course, treatment, and outcome of the common complications of cataract and anterior segment surgery (eg, intraoperative floppy iris syndrome, corneal edema, IOP elevation, hyphema, endophthalmitis, toxic anterior segment syndrome (TASS), cystoid macular edema (CME), retinal detachment, IOL dislocation, lens-induced glaucoma, uveitis).\*\*
13. Describe the indications for, principles of, and techniques of yttrium aluminium garnet (YAG) laser capsulotomy, and understand the proper timing of YAG laser capsulotomy.\*\*

14. Describe advanced IOL power calculation (eg, after radial keratotomy [RK], myopic laser-assisted in situ keratomileusis [LASIK]/photorefractive keratectomy [PRK], hyperopic LASIK/PRK).\*\*
  15. Describe the properties of different ophthalmic viscoelastic devices (OVDs) (eg, dispersive, cohesive, adaptive) and the advantages and disadvantages for certain phases of surgery.\*\*
  16. Describe the fluid dynamics in phacoemulsification, including the difference between peristaltic and venture pump types.\*\*
  17. Recognize and treat common postoperative complications of cataract surgery (eg, endophthalmitis, toxic anterior segment syndrome, elevated IOP, CME, wound leak, uveitis, capsular block syndrome).\*\*
  18. Define the more complex indications for cataract surgery (eg, better view of posterior segment, lens-induced glaucoma).\*\*
  19. Describe the techniques to manage a small pupil, including mechanical manipulation, management of iris membrane, iris hooks, viscoelastic, and phaco techniques.
  20. Describe techniques to diagnose and operate on patients with posterior polar cataract.
  21. Describe the preoperative preparations for surgery and special intraoperative considerations for patients with uveitis.
  22. Describe techniques for prevention of capsular opacification and phimosis (before, during, after surgery), including the use of capsular tension rings and IOL factors.
- B. Technical/Surgical Skills
1. Perform local injections of corticosteroids, antibiotics, and anesthetics, including retrobulbar and subtenons.\*\*
  2. Perform extracapsular surgery in a practice setting (eg, animal or practice lab).\*\*
  3. Practice surgery in the operating room under supervision, including mastery of the following skills:
    - a. Wound construction\*\*
    - b. Anterior capsulotomy/capsulorhexis\*\*
    - c. Instillation and removal of viscoelastics\*\*
    - d. Hydrodissection and hydrodelineation\*\*
    - e. Extracapsular technique\*\*
    - f. Beginning phacoemulsification techniques (eg, sculpting, divide and conquer, phaco chop)\*\*
    - g. Irrigation and aspiration\*\*
    - h. Cortical cleanup\*\*
    - i. IOL implantation (eg, anterior and posterior, special IOLs)\*\*
    - j. Wound suturing\*\*
    - k. Wound hydration\*\*
  4. Perform paracentesis of the anterior chamber.\*\*
  5. Implement advanced applications of viscoelastics in surgery (eg, control of iris prolapse, elevation of dropped nucleus, viscodissection, aspiration of residual/retained viscoelastic, soft shell technique).\*\*

### **Advanced Level Goals: Year 3**

#### A. Cognitive Skills

1. Describe the principles, indications for, mechanics of, and performance of contact and immersion A-scan ultrasonography and calculation of IOL power.\*\*
2. Describe the performance of and describe the complications of more advanced anterior segment surgery (eg, pseudoexfoliation, small pupils, intraoperative floppy iris syndrome, mature cataract, hard nucleus, posttraumatic, zonular dehiscence, cataract surgery after pars plana vitrectomy, short eye, corneal endothelial diseases).
3. Describe the use of special devices for cataract surgery in complex situations such as specialized IOLs, capsular tension rings and segments, iris hooks, Malyugin ring, use of indocyanine green/trypan blue staining of the anterior capsule.
4. Describe IOL fixation options in the lack of capsular support for in the bag fixation (anterior chamber [AC] IOL, sulcus fixation +/- optic capture, iris fixation, scleral fixation).
5. Describe the indications for, techniques of, and complications of cataract extraction in the context of the subspecialty disciplines of the following:
  - a. Glaucoma (eg, combined cataract and glaucoma procedures, glaucoma in cataractous eyes, cataract surgery in patients with prior glaucoma surgery)\*\*
  - b. Retina (eg, cataract surgery in patients with scleral buckles or prior vitrectomy)\*\*
  - c. Cornea (eg, cataract extraction in patients with corneal opacities)\*\* and the use of fiber optic for better visualization
  - d. Ophthalmic plastic surgery (eg, ptosis following cataract surgery)\*\*
  - e. Refractive surgery (eg, cataract surgery in eyes that have undergone refractive surgery)\*\*
6. Independently evaluate and establish a management plan for complications of cataract and IOL implant surgery (eg, posterior capsular tears, vitreous prolapse, intravitreal dislocation of cataractous fragments, corneal wound burn, expulsive hemorrhage, choroidal effusions, damage to the iris tissue).\*\*
7. List indications for and techniques of intracapsular surgery (eg, rare cases may require this procedure, or patients may have had the procedure performed previously).\*\*
8. Describe instrumentation and techniques used to implant foldable and nonfoldable IOLs.\*\*
9. Describe the evaluation and management of common and uncommon causes of postoperative endophthalmitis and TASS.\*\*
10. Describe the causes and indication for performing, repositioning, removal, or exchange of IOLs.\*\*
12. Describe the government and hospital regulations that apply to cataract surgery.
13. Describe the indication and option for astigmatism management during cataract surgery (eg, on axis incision, limbal relaxing incisions [LRI], opposite clear corneal incision [OCCI], toric IOL).
14. Describe the use of corneal topography and wavefront analysis to help select the best type of IOL for a patient especially following keratorefractive surgery.
15. Describe the option for presbyopic correction solutions during cataract surgery (eg, monovision, multifocal IOLs, accommodative IOLs, dual optic IOLs).
16. Describe the mechanisms of actions, indications, contraindications, advantages, and disadvantages of premium IOLs (eg, multifocal, accommodative, toric, aspheric, blue blocker, intraocular miniature telescope).

17. Describe evaluation and management of IOL complications (eg, intraoperative damage to IOL, postoperative IOL opacification, dislocation, sublocation).\*\*
  18. Describe the advantages and disadvantages of the materials used for IOL fabrication (eg, poly-methylmethacrylate [PMMA], silicone, hydrophobic acrylic, hydrophilic acrylic).
  19. Describe lens/IOL surgery solutions for myopia and hyperopia (eg, refractive lens exchange, phakic IOLs).
- B. Technical/Surgical Skills
1. Assist in the teaching and supervision of basic and standard level learners.
  2. Perform phacoemulsification in a practice setting (eg, animal or practice lab) and then in the operating room, ideally 50-100 cases of a combination of phacoemulsification and ECCE, including mastery of the following skills:
    - a. Wound construction
    - b. Anterior capsulotomy/capsulorhexis
    - c. Viscoelastics
    - d. Intracapsular, extracapsular, and phacoemulsification techniques (eg, sculpting, divide and conquer, stop and chop, phaco chop)
    - e. Instrumentation and techniques of irrigation and aspiration
    - f. IOL implantation (eg, anterior and posterior, foldable and nonfoldable)
    - g. IOL repositioning, removal, or exchange
  3. Perform intraoperative and postoperative management of any event that may occur during or as a result of cataract surgery, including:
    - a. Vitreous loss
    - b. Capsular rupture
    - c. Anterior or posterior segment bleeding
    - d. Positive posterior pressure
    - e. Choroidal detachments
    - f. Expulsive hemorrhage
    - g. Loss of anesthesia
    - h. Elevated intraocular pressure
    - i. Use of topical and systemic medications
    - j. Astigmatism
    - k. Postoperative refraction (simple and complex)
    - l. Corneal edema
    - m. Wound dehiscence
    - n. Hyphema
    - o. Residual cortex
    - p. Dropped nucleus
    - q. Uveitis
    - r. CME
    - s. Elevated intraocular pressure and glaucoma
    - t. Postoperative early and late intraocular infection
    - u. Corneal burn
    - v. Intraoperative floppy iris syndrome

**Very Advanced Level: Subspecialist**



## A. Cognitive Skills

1. Describe the issues of pediatric cataract surgery. including the indications for surgery (posterior capsulotomy +/- anterior vitrectomy), IOL implantation, unilateral and bilateral congenital cataract, and IOL calculation in young children.
2. Describe the management of cataract associated with aniridia.
3. Describe the treatment options for "dropped IOL" and indications for referral to a vitreoretinal surgeon.
4. Describe the advantages and strategies for advanced phacoemulsification techniques such as torsional or transversal ultrasound, small incision and microincision cataract surgery (MICS), biaxial MICS cataract surgery.
5. Describe the parameters, power, and fluidics in MICS.
6. List the indications for triple procedures or combined surgeries (eg, phaco plus trabeculectomy, keratoplasty, silicone-oil removal).
7. List the Indications for "premium" IOLs (eg, multifocal, accommodating, toric).
8. Describe the surgical difficulties of hypermature (Morgagnian) cataract.
9. Describe the treatment options for eyes with shallow anterior chamber and cataract including high-degree hyperopic eyes and piggyback IOL implantation.
10. Describe the treatment of cataract in patients with an intraocular tumor (eg, melanoma, retinoblastoma).
11. Describe the methods to determine typical surgically induced astigmatism and surgeon specific A-constant.
12. Describe the etiology and management of unexpected postoperative refractive errors, including hyperopic and myopic shifts (eg, capsular phimosis, capsular block, upside down IOL).
13. Describe the management strategies to reposition of decentered, tilted, subluxated, and dislocated IOLs.

## B. Technical/Surgical Skills

1. Perform surgery on congenital cataract, including IOL power calculation.
2. Perform and teach small incision and MICS, torsional, or transversal ultrasound.
3. Perform and teach triple procedures or combined surgeries (eg, phaco and trabeculectomy, keratoplasty, silicone-oil removal).
4. Implant "premium" IOLs (eg, multifocal, accommodating, toric) and counsel patients preoperatively and postoperatively.
5. Perform surgery on patients with complex lens issues, including:
  - a. Aniridia, iris coloboma, iris dialysis
  - b. Hypermature (Morgagnian) cataract
  - c. Eyes with shallow anterior chamber
  - d. High-degree myopic eyes
6. Perform reposition of malpositioned IOLs and late subluxation of IOL/capsule.

\* \* \*

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### **III. Contact Lenses**

#### **Basic Level Goals: Year 1**

##### **A. Cognitive Skills**

1. List advantages and disadvantages of contact lens (CL) wear.\*\*
2. List indications and contraindications for CL wear.\*\*
3. List medical indications for CL wear.\*\*
4. Describe a systematic and comprehensive ophthalmic examination oriented for CL fitting, including complex and challenging cases.\*\*
5. Describe the various CL indications and options for each contact lens type (eg, soft CL [SCL], rigid gas permeable [RGP] CL, toric CL, multifocal CL, scleral CL).\*\*
6. Describe how to decide which CL categories (eg, SCL, RGP CL, hybrid CL, and subgroups within each category (eg, sphere, toric, bifocal, frequent planned replacement) are best suited for a particular patient.\*\*
7. Describe how to convey the basic CL parameters for SCL and RGP CL:\*\*
  - a. Base curve\*\*
  - b. Diameter refractive power\*\*
  - c. Lens materials\*\*
    - i. Center thickness\*\*
    - ii. Peripheral curvature\*\*
8. Explain the concept and clinical relevance of oxygen permeability (Dk) and oxygen transmissibility (Dk/center thickness).\*\*
9. Describe various materials used in the manufacture of CL.
10. Explain the optics of SCL and RGP CL:\*\*
  - a. Base curve changes\*\*
  - b. Lacrimal lens\*\*
  - c. Vertex distance\*\*
  - d. Optic zone.\*\*
11. Recognize the importance of obtaining central keratometry in CL fitting of patients without complex needs, and explain the conversion between radians and diopters.\*\*
12. Identify different methods of obtaining central keratometry readings (eg, manual keratometry, computerized corneal topography).
13. Explain the importance of using diagnostic staining agents (eg, fluorescein, lissamine green, rose bengal) to assess corneal and conjunctival staining patterns.\*\*
14. Describe basic tests to assess the tear film properties (eg, Schirmer test, tear break-up time, phenol red thread tear test, meibomian gland assessment).\*\*
15. Describe conversion of a spectacle prescription (Rx) to a CL Rx, including method of converting from plus to minus cylinder and vertex distance calculations.\*\*
16. Describe basic steps for SCL fitting.\*\*
17. Identify the main characteristics to be present in a CL prescription (eye designation, brand identification, base curve, diameter, and refractive power).\*\*
18. Describe CL care guidelines to be given to the patient related to insertion, removal, and disinfection of CL.\*\*
19. Describe risk factors for CL-related complications (eg, overnight wear, nonpreserved saline solution usage).\*\*

20. Describe treatment of CL-related complications (eg, tight lens syndrome, overwear syndrome, giant papillary conjunctivitis, infectious keratitis).\*\*

**B. Technical/Surgical Skills**

1. Perform a basic CL history.\*\*
2. Perform all the steps of a basic clinical examination oriented for CL fitting (ie, refraction, keratometry, visual acuity assessment).\*\*
3. Perform a routine comprehensive slit-lamp examination of the anterior segment as applied to CL fitting.\*\*
4. Perform tear film assessment required for CL patients.\*\*
5. Perform the techniques of retinoscopy, refraction, and over-refraction in the routine CL patient.\*\*
6. Perform central keratometry.\*\*
7. Discuss with the patient the most appropriate choice for their particular clinical case.\*\*
8. Perform initial SCL fitting, evaluation of fit (loose CL versus tight CL), and over-refraction.\*\*
9. Insert and remove a trial SCL.\*\*
10. Instruct patients regarding safe CL insertion and removal, CL wearing schedule, lens care regimens, CL disinfection care, indications, contraindications, and possible complications.\*\*
11. Work effectively within a medical care team.\*\*

**Standard Level Goals: Year 2**

**A. Cognitive Skills**

1. Explain applied anatomy and physiology (eg, corneal metabolism and temperature, oxygen consumption, stromal acidosis, tear osmolarity, tissue fragility, cell apoptosis, corneal sensitivity, closed eyelid-related ocular surface repercussions).\*\*
2. Recognize signs and symptoms of CL intolerance and overwear.\*\*
3. Explain the importance of assessing tear film and ocular surface condition with more complex auxiliary tests in certain CL fitting situations (eg, tear film osmolarity and biochemical composition, impression cytology).
4. Identify CL fitting situations requiring corneal topography (eg, computerized/Placido rings).\*\*
5. Explain the rationale underlying different topography profiles and how these relate to the manifest refraction.\*\*
6. Summarize and analyze topography maps.
7. Explain physical properties of CL materials:
  - a. International Organization for Standardization (ISO) classification
8. Explain advantages and disadvantages of SCL materials.\*\*
9. Explain advantages and disadvantages of RGP CL materials.\*\*
10. Explain RGP/SCL geometry relation with corneal geometry (ie, lacrimal meniscus, refraction, and ocular surface implications).\*\*
11. Explain main principles to fit RGP CL (eg, first trial CL choice, fluorescein patterns, alignment, movement, wearing and replacement schedule, fitting motivation, and follow up).\*\*
12. Explain main principles to fit toric SCL.\*\*

- a. Stabilization\*\*
    - i. LARS rule (ie, Left Add, Right Subtract)
    - ii. Movement
    - iii. Rotation
    - iv. Possible refitting needs
  13. Appraise clinical situations best suited for RGP CL fitting versus toric SCL fitting.\*\*
  14. Explain when CL refitting is indicated and perform refitting when needed.\*\*
  15. Recognize signs and symptoms of a tight, optimal, and loose CL fitting.\*\*
  16. Explain advantages and disadvantages of different wearing schedules (eg, conventional, frequent planned replacement, flexible, daily).\*\*
  17. Describe ocular impact and physiological needs regarding different CL wearing schedules.
  18. Identify and describe CL requirements for materials needed for extended/flexible CL wearing.\*\*
  19. Explain patient and CL selection and fitting techniques as applied to fit presbyopia.\*\*
  20. Explain how to keep a CL fitting trial set (ie, CL, equipment, and disinfection care).\*\*
  21. Describe and evaluate different CL care systems.
  22. Explain the clinical importance of CL environment (ie, CL patient surrounding, ocular surface, and storage case).\*\*
- B. Technical Skills
1. Perform a CL history in patients requiring more complex CL fitting (eg, subclinical ectatic corneal disorders such as keratoconus and pellucid marginal degeneration, regular moderate astigmatism, presbyopia, ocular surface disease, and post-refractive surgery).\*\*
  2. Perform a clinical examination, including retinoscopy and refraction techniques to verify and inspect CL in patients requiring more complex CL fitting (eg, subclinical ectatic corneal disorders such as keratoconus and pellucid marginal degeneration, regular moderate astigmatism, presbyopia, ocular surface disease, and post-refractive surgery).\*\*
  3. Indicate more complex additional auxiliary tests (eg, computer-based corneal topography, tear film osmolarity, impression cytology) in patients requiring more complex CL fitting (eg, subclinical ectatic corneal disorders such as keratoconus, pellucid marginal degeneration, regular moderate astigmatism, presbyopia, ocular surface disease, and post-refractive surgery).
  4. Perform RGP CL fitting (spherical).\*\*
  5. Perform SCL toric fitting.\*\*
  6. Perform presbyopia CL fitting.\*\*
  7. Perform appropriate CL selection and material or parameters modification in CL refit.\*\*
  8. Perform CL verification for visual acuity, fitting, and comfort in patients requiring more complex CL fitting.\*\*
  9. Educate patients regarding CL-related complications.\*\*
  10. Diagnose, manage, and treat CL-related complications.\*\*
  11. Perform the skills needed for long-term management and follow up of CL patients.\*\*

### **Advanced Level Goals: Year 3**

#### A. Cognitive Skills

1. Describe the various options for SCL, RPG CL, and hybrid CL fitting in advanced ectatic corneal disorders such as keratoconus and pellucid marginal degeneration, including post-intracorneal ring segment implantation cases.\*\*
  2. Describe the various options for SCL and RPG CL fitting in postkeratoplasty cases.\*\*
  3. Describe the various options for SCL and RPG CL fitting in complex post-refractive surgery, including corneal ectasia.\*\*
  4. Describe CL fitting in special clinical situations such as severe dry eye, glaucoma, diabetes, allergy, pregnancy, strabismus, sports practice, adverse environmental and occupational conditions.\*\*
  5. Describe indications, fitting techniques, and long-term management of CL wear for children and adolescents.\*\*
  6. Describe CL options and most complex fitting techniques for medical CL indications such as aphakia, albinism, recurrent corneal erosions, neurotrophic keratitis, corneal scarring, aniridia, and prosthetic cosmesis.\*\*
  7. Identify indications for scleral CL fitting.\*\*
  8. Explain reverse geometry RGP CL for post-graft or post-refractive surgery cases.\*\*
  9. Synthesize the concept underlying orthokeratology.
  10. List the indications for therapeutic CL.\*\*
  11. Describe material selection, physiological implications, mechanisms of action, and adjuvant topical treatment associated with therapeutic CL.\*\*
  12. Describe the various possibilities of fitting with soft and hard therapeutic CL.
  13. Explain the importance of appreciating visual acuity, fit, and comfort in therapeutic CL.\*\*
  14. Describe the differences among CL material choices especially suited for more complex cases and its clinical correlation.\*\*
  15. Explain the influence of both systemic and topical medication on CL fitting and tolerance.\*\*
  16. Describe the methods of modifying a CL to improve comfort, vision, or physiological response.\*\*
  17. Evaluate CL-induced complications, and describe treatment strategies for their management, in particular acanthamoeba and fungi infections.\*\*
  18. Appraise clinical situations requiring additional complementary examinations in CL fitting and follow up (eg, endothelial, confocal biomicroscopy, aberrometry).
  19. Describe indications and methods for fitting front surface toric, back surface toric, and bitoric RGP CL.
- B. Technical Skills
1. Perform an advanced CL history and examination.\*\*
  2. Obtain a full ocular history and conduct necessary tests to perform a complex CL fitting examination (eg, postkeratoplasty, multiple surgeries, post-refractive surgery, corneal ectasia, advanced corneal ectatic disorders such as keratoconus and pellucid marginal degeneration, and active corneal and ocular surface disease).\*\*
  3. Perform CL fitting and management in babies, children, and adolescents.\*\*
  4. Perform scleral CL fitting.
  5. Perform refraction, retinoscopy, and over-refraction in complex cases.\*\*
  6. Use advanced CL designs including reverse geometry.\*\*

7. Indicate the auxiliary CL instruments in patients with complex needs (eg, computerized topography, fluorescein patterns, diagnostic lenses).\*\*
8. Interpret and interpret topography in complex CL fittings.\*\*
9. Perform and analyze aberrometry and endothelial/confocal biomicroscopy.
10. Indicate CL modification and refitting in complex cases, when needed.\*\*
11. Select the appropriate CL in complex clinical cases (eg, postkeratoplasty, multiple surgeries, post-refractive surgery, corneal ectasia, advanced ectatic corneal disorders such as keratoconus, pellucid marginal degeneration, and active corneal and ocular surface disease).\*\*
12. Perform therapeutic CL fitting and follow up.\*\*
13. Diagnose and treat CL-induced complications, both infectious and noninfectious (eg, sterile infiltrates, corneal neovascularization, corneal permanent staining, giant papillary conjunctivitis).\*\*
14. Develop an educational skill set to effectively educate rotating students and residents about CL topics.\*\*

\* \* \*

***Note:** Inclusion of therapies and investigations in the ICO Residency Curriculum does not imply that listings are all inclusive or that methods are endorsed by the ICO. Appropriate levels of expertise and knowledge should be achieved based on the care provided. Practitioners should know of therapies and investigations not available at their hospital or clinic, so that they can advise patients who may be able to seek care elsewhere.*

## IV. Cornea and External Diseases

### Basic Level Goals: Year 1

#### A. Cognitive Skills

1. Describe the basic anatomy, embryology, physiology, pathology, microbiology, immunology, genetics, epidemiology, and pharmacology of the cornea, conjunctiva, sclera, eyelids, lacrimal apparatus, and ocular adnexa.\*\*
2. Understand the fundamentals of corneal optics and refraction (eg, astigmatism, keratoconus).\*\*
3. Describe congenital abnormalities of the cornea, sclera, and globe (eg, Peter anomaly, microphthalmos, birth trauma, buphthalmos).\*\*
4. Describe characteristic corneal and conjunctival degenerations (eg, pterygium, pinguecula, Salzmann nodular degeneration, senile plaques of the sclera).\*\*
5. Recognize the classic corneal dystrophies (eg, map-dot-fingerprint dystrophy, lattice dystrophy, granular dystrophy, macular dystrophy, Fuchs dystrophy).\*\*
6. Describe the fundamentals of ocular microbiology and recognize corneal and conjunctival inflammations and infections (eg, staphylococcal hypersensitivity, simple microbial keratitis, fungal corneal ulcers, trachoma, ophthalmia neonatorum, herpes zoster ophthalmicus, herpes simplex keratitis, adenovirus keratoconjunctivitis and conjunctivitis).\*\*
7. Describe the basic principles of ocular pharmacology of anti-infective, anti-inflammatory, and immune modulating agents (eg, indications and contraindications for topical corticosteroids, nonsteroidal anti-inflammatory agents, and antibiotics).\*\*
8. Recognize and treat lid margin disease (eg, staphylococcal blepharitis, meibomian gland dysfunction).\*\*
9. Describe the basic differential diagnosis of acute and chronic conjunctivitis or red eye (eg, scleritis, episcleritis, conjunctivitis, orbital cellulitis, gonococcal and chlamydial conjunctivitis).\*\*
10. Recognize and treat pyogenic granuloma.\*\*
11. Recognize the basic presentations of ocular allergy (eg, phlyctenules, seasonal hay fever, vernal conjunctivitis, allergic and atopic conjunctivitis, giant papillary conjunctivitis).\*\*
12. Understand the mechanisms of ocular immunology and recognize the external manifestations of anterior segment inflammation (eg, red eye associated with acute and chronic iritis).\*\*
13. Describe the symptoms, signs, testing, and evaluation for dry eye (eg, Schirmer test, tarsorrhaphy); and treatment for dry eye.\*\*
14. Describe the etiologies and treatment of superficial punctate keratopathy (eg, dry eye, Thygeson superficial punctate keratopathy, neurotrophic keratitis, blepharitis, toxicity, ultraviolet photo keratopathy, contact lens-related keratitis).\*\*
15. Recognize and describe the etiologies of hyphema and microhyphema.\*\*
16. Describe the basic mechanisms of traumatic and toxic injury to the anterior segment and treatment (eg, chemical and thermal burns, lid laceration, orbital fracture).\*\*
17. Recognize corneal lacerations (perforating and nonperforating), anterior segment trauma, corneal and conjunctival foreign bodies.\*\*

18. Describe the epidemiology, differential diagnosis, evaluation, and management of common benign and malignant lid lesions, including pigmented lesions of the conjunctiva and lid (eg, nevi, melanoma, primary acquired melanosis, ocular surface squamous neoplasia).\*\*

**B. Technical/Surgical Skills**

1. Perform external examination (illuminated and magnified) and slit-lamp biomicroscopy, including drawing of anterior segment findings.\*\*
2. Administer topical anesthesia, as well as special topical stains of the cornea (eg, fluorescein dye and rose bengal).\*\*
3. Perform tests for dry eye (eg, Schirmer test, tear film breakup, and dye disappearance).\*\*
4. Perform punctal occlusion (temporary or permanent) or insert plugs.\*\*
5. Perform simple corneal sensation testing (eg, cotton-tipped swab).\*\*
6. Perform tonometry (eg, applanation, Tono-Pen, Schiøtz, pneumotonometry).\*\*
7. Perform techniques of sampling for viral, bacterial, fungal, and protozoal ocular infections (eg, corneal scraping and appropriate culture techniques).\*\*
8. Interpret simple stains of the cornea and conjunctiva (eg, Gram stain, Giemsa stain).\*\*
9. Manage corneal epithelial defects (eg, pressure patching and bandage contact lenses).\*\*
10. Perform removal of a conjunctival or corneal foreign body (eg, rust ring).\*\*
11. Perform simple (nonrecurrent) pterygium excision (eg, with autologous conjunctival transplantation).\*\*
12. Perform an isolated lid laceration repair.\*\*
13. Perform an isolated corneal laceration repair (eg, linear laceration not extending to limbus, not involving uveal or intraocular structures).\*\*
14. Perform epilation.\*\*
15. Perform a lateral tarsorrhaphy.\*\*
16. Perform incision, drainage, and/or remove a primary chalazion/stye.\*\*
17. Perform a simple incisional or excisional biopsy of a lid lesion.\*\*
18. Perform irrigation of chemical burn to the eye.\*\*
19. Perform Seidel test.\*\*

**Standard Level Goals: Year 2**

**A. Cognitive Skills**

1. Describe the more complex anatomy, embryology, physiology, pathology, microbiology, immunology, genetics, epidemiology, and pharmacology of the cornea, conjunctiva, sclera, eyelids, lacrimal apparatus, and ocular adnexa.
2. Describe the more complex congenital abnormalities of the cornea, sclera, anterior segment and globe and their associated systemic manifestations (eg, Axenfeld, Rieger, and Peter anomalies, aniridia, hamartomas and choristomas).
3. Understand more complex corneal optics and refraction (eg, irregular astigmatism, keratoconus, anisometropia).
4. Correlate the concordance of the visual acuity with the density of media opacity (eg, cataract, corneal scars, edema), and evaluate the etiology of discordance between acuity and findings from examination of the media.



5. Recognize and treat less common corneal or conjunctival presentations of degenerations and common conjunctival neoplasms (eg, inflamed, atypical, or recurrent pterygium, band keratopathy, benign and malignant tumors).
6. Describe the epidemiology, clinical features, pathology, evaluation, and treatment of peripheral corneal thinning disorders or ulceration (eg, Terrien marginal degeneration, Mooren ulcer, rheumatoid arthritis-related corneal melt, dellen).
7. Describe the epidemiology, differential diagnosis, evaluation, and management of vitamin A deficiency (eg, Bitot spot, dry eye, slowed dark adaptation) and neurotrophic corneal diseases.
8. Recognize and treat recurrent corneal erosions.
9. Recognize, evaluate, and treat chronic conjunctivitis (eg, chlamydia, trachoma, molluscum contagiosum, Parinaud oculoglandular syndrome, ocular rosacea).
10. Describe more complex ocular microbiology and describe the differential diagnosis of more complicated corneal and conjunctival infections (eg, complex, mixed, or atypical bacterial, fungal, Acanthamoeba, viral, or parasitic keratitis).
11. Describe the more complex principles of ocular pharmacology of anti-infective, anti-inflammatory, and immune modulating agents (eg, use of topical nonsteroidal and steroidal agents, cyclosporine, and anti-tumor necrosis factor agents).
12. Describe the differential diagnosis, evaluation, and management of Thygeson superficial punctate keratopathy.
13. Describe more complex differential diagnosis of red eye (eg, autoimmune and inflammatory disorders causing scleritis, episcleritis, conjunctivitis, orbital cellulitis).
14. Describe key features of trachoma, including epidemiology, clinical features, staging, and its complications (eg, cicatrization), prevention (eg, facial hygiene), and topical and systemic antibiotic treatment (especially in hyperendemic regions), and surgery (eg, tarsal rotation).
15. Describe differential diagnosis, evaluation, and treatment of interstitial keratitis (eg, syphilis, viral diseases, noninfectious, immunologic, inflammation).
16. Describe the differential diagnosis and the external manifestations of more complex anterior segment inflammation (eg, acute and chronic iritis with and without systemic disease).
17. Recognize, evaluate, and treat the ocular complications of severe diseases, such as chronic exposure keratopathy, contact dermatitis, and rosacea.
18. Describe the clinical features, pathology, evaluation, and treatment of ocular cicatricial pemphigoid and Stevens-Johnson syndrome.
19. Describe the classification, pathology, indications for surgery, and prognosis of common eyelid abnormalities (eg, blepharoptosis, trichiasis, distichiasis, essential blepharospasm, entropion, ectropion) and understand their relationship to secondary diseases of the cornea and conjunctiva (eg, exposure keratopathy).
20. Recognize and treat foreign body, animal, and plant substance injuries and understand the risk of injury with organic material.
21. Describe more complex mechanisms of traumatic and toxic injury to the anterior segment (eg, long-term sequelae of acid and alkali burn, complex lid laceration involving the lacrimal system, full-thickness laceration).
22. Recognize and treat corneal lacerations (perforating and nonperforating).
23. Recognize and treat more complex hyphemas (eg, surgical indications, evacuation).

24. Recognize the anterior segment manifestations of systemic diseases (eg, Wilson disease) and pharmacologic side effects (eg, amiodarone vortex keratopathy).
  25. Recognize and treat common and uncommon benign and malignant lid lesions.
- B. Technical/Surgical Skills
1. Perform more advanced techniques, including keratometry, keratoscopy, endothelial cell count and/or evaluation, specular microscopy, and pachymetry.\*\*
  2. Perform stromal micropuncture.\*\*
  3. Perform application of corneal glue.\*\*
  4. Perform simple keratectomy and lamellar keratectomy.\*\*
  5. Assist in more complex corneal surgery (eg, penetrating keratoplasty and lamellar keratoplasty).\*\*
  6. Perform more complex and recurrent pterygium excision, including conjunctival grafting.\*\*
  7. Perform more complex lid laceration repair.\*\*
  8. Perform more complex corneal laceration repair (eg, stellate perforating laceration).\*\*
  9. Perform and interpret more complex stains of the cornea and conjunctiva (eg, calcofluor white, acid fast).
  10. Repair simple lacerations of the lacrimal drainage apparatus (eg, perform intubations and primary closure).
  11. Treat hyphema and microhyphema with associated increased intraocular pressure and/or blood staining (eg, surgical evacuation).

### **Advanced Level Goals: Year 3**

- A. Cognitive Skills
1. Describe the most complex anatomy, embryology, physiology, histopathology, microbiology, immunology, genetics, epidemiology, and pharmacology of the cornea, conjunctiva, sclera, eyelids, lacrimal apparatus, and ocular adnexa.
  2. Understand the most complex corneal optics and refraction (eg, postkeratoplasty) and their methods of treatment (eg, contact lenses, refractive surgery).
  3. Describe the most complex and less common congenital abnormalities of the cornea, sclera, and globe (eg, cornea plana, keratoglobus).
  4. Recognize the less common corneal dystrophies and degenerations (eg, Meesman dystrophy, Reis-Buckler dystrophy, François syndrome, Schnyder crystalline dystrophy, congenital hereditary stromal dystrophy, congenital hereditary endothelial dystrophy, posterior polymorphous dystrophy) in addition to the more common dystrophies (eg, anterior membrane dystrophy, granular, lattice, and macular).
  5. Recognize common and uncommon corneal and conjunctival neoplasms and degenerations (eg, spheroidal degeneration, carcinoma in situ).
  6. Describe less common and rare ocular infections, and describe the differential diagnosis of the most complicated corneal and conjunctival infections (eg, amoebas, leishmaniasis, nematodes).
  7. In nonendemic areas, describe the basic features of onchocerciasis.
  8. In endemic areas, define the etiology, vector (eg, black fly), and incidence, diagnostic features (eg, microfilariae, keratitis, iritis), diagnosis (eg, skin snip test), course and

prognosis, treatment (eg, ivermectin, nodulectomy), and prevention (eg, vector control, environmental and behavioral changes) of onchocerciasis.

9. Describe the most complex principles of ocular pharmacology of anti-infective, anti-inflammatory, and immune modulating agents (eg, combination therapies of antiviral and anti-inflammatory agents).
  10. Describe the most complex differential diagnosis of red eye (eg, pemphigoid, pemphigus, Stevens-Johnson syndrome).
  11. Describe the differential diagnosis and the external manifestations of the most complex or uncommon anterior segment inflammations (eg, syphilitic keratouveitis).
  12. Diagnose and treat the most complex traumatic and toxic injuries to the anterior segment (eg, total lid avulsion, severe alkali burn).
  13. Recognize and treat complex corneal lacerations (eg, lacerations extending beyond the limbus, uveal involvement).
  14. Diagnose and treat the most severe corneal exposure cases (eg, conjunctival flap).
  15. Describe the indications for ocular surface transplantation, including conjunctival autograft/flap, amniotic membrane transplantation, and limbal stem cell transplantation.
  16. Describe the surgical indications (eg, Fuchs dystrophy, aphakic/pseudophakic bullous keratopathy, keratoconus), surgical techniques, and recognition and management of postoperative complications (especially immunologically-mediated rejection) of corneal transplantation (eg, penetrating, lamellar).
- B. Technical/Surgical Skills
1. Perform and interpret the most advanced corneal techniques (eg, endothelial microscopy, computerized corneal topography and tomography, anterior segment ocular coherence tomography).\*\*
  2. Perform a thin conjunctival flap (eg, Gunderson flap).
  3. Perform specialized and complicated fitting of contact lenses (eg, postkeratoplasty, advanced keratoconus).
  4. Perform more complex corneal surgery (eg, penetrating or lamellar keratoplasty, keratorefractive procedures, and phototherapeutic keratectomy), and understand the postoperative management including postkeratoplasty astigmatism management and graft rejection.
  5. Perform other complex conjunctival surgery (eg, autograft, stem cell transplant).
  6. Manage and treat more complex neoplasms of the conjunctiva (eg, carcinoma, melanoma).

### **Very Advanced Level Goals: Subspecialist**

*Fellowship training requires more in-depth education about the pathophysiology and management than can usually be obtained in residency training in ophthalmology. Fellowships include a continuous period of intense and focused training in developing and maintaining knowledge, skills, scholarship, and professionalism. A fellow should be knowledgeable and proficient in all the activities listed for residency training. Subspecialty fellowship training should include a more in-depth exposure and understanding of the diagnosis and medical management of diseases of the eyelids, conjunctiva, cornea/sclera, and anterior ocular segment, as well as recognition and treatment of posterior segment disease that may affect the anterior segment. Subspecialty fellowship training should include hands-on training covering surgery of the conjunctiva, cornea/sclera, anterior segment, lens, and anterior vitreous, with special*

*emphasis on corneal transplantation and related procedures. The fellow should be exposed to opportunities to develop research skills. A specific block of time may be set aside for clinical or laboratory research.*

#### A. Cognitive Skills

1. Recognize acute and chronic blepharitis, including both infectious and noninfectious etiologies, with emphasis on microbial blepharitis, meibomian gland dysfunction, and rosacea.\*\*
2. Recognize acute and chronic conjunctivitis, neonatal conjunctivitis, chlamydial disease, adenoviral conjunctivitis, allergic conjunctivitis, and bacterial conjunctivitis.\*\*
3. Recognize acute and chronic infectious keratitis including bacterial, viral, fungal, and parasitic, with emphasis on herpes simplex, herpes zoster, adenovirus, acanthamoeba, and contact lens-associated problems.\*\*
4. Recognize noninfectious keratitis including marginal keratitis, central ulcerative keratitis, epitheliopathy, endothelialitis, and interstitial keratitis.\*\*
5. Recognize anterior segment anomalies, including various anomalies associated with specific genetic abnormalities, corneal dystrophies, and corneal degenerations.\*\*
6. Recognize autoimmune and immunologic diseases of the anterior segment including allergy, corneal graft rejection, and cicatrizing conjunctivitis.\*\*
7. Recognize and be familiar with oral and topical immunosuppression and anti-allergy medications.\*\*
8. Describe fundamentals of anterior segment anatomy, chemistry, physiology, and wound healing including tear formation and function, corneal topography/tomography, endothelial cell function, and maintenance of corneal clarity.\*\*
9. Understand principles of anterior segment pharmacology including antimicrobial, anti-inflammatory, ocular hypotensive and immunosuppressive agents, with emphasis on bioavailability, mechanism of actions, relative efficacy, safety, and potential complications.\*\*
10. Demonstrate fundamental knowledge of contact lens physiology, design and materials, and complications for both cosmetic and therapeutic use.\*\*
11. Develop proficiency in performing diagnostic techniques including biomicroscopy, specular microscopy, corneal topography/tomography, vital stains of the ocular surface, corneal biopsy techniques and interpretation, and corneal pachymetry.\*\*
12. Develop proficiency in medical and surgical management of corneal thinning and perforation, including techniques of pharmacological manipulation; and office procedures, such as application of tissue glue and therapeutic contact lenses.\*\*
13. Demonstrate a detailed understanding of cornea and conjunctival pathology results and interpretation of ocular cultures.\*\*
14. Complete an eye-banking curriculum, including a review of specific eye banking functions (recovery, processing, storage, evaluation, and distribution of tissue), donor eligibility, and donor selection.\*\*
15. Demonstrate skill in use of reference material, including electronic searching and retrieval of relevant articles, monographs, and abstracts.\*\*

#### B. Technical/Surgical Skills

1. Demonstrate skill in anterior segment surgery including eyelid, conjunctival, scleral, and corneal procedures, with emphasis on corneal protective procedures (eg, tarsorrhaphy),

reconstruction of the ocular surface, surgical management of corneal erosions, and phototherapeutic keratectomy.\*\*

2. Demonstrate skill in penetrating and lamellar keratoplasty, with emphasis on patient selection, surgical technique, and postoperative care including recognition and management of graft rejection and endophthalmitis and advanced techniques for lamellar and penetrating keratoplasty, including full thickness and lamellar transplants and endothelial keratoplasty.\*\*
3. The fellow should receive instruction and develop surgical proficiency in both full-thickness penetrating keratoplasty and selective endothelial keratoplasty and lamellar keratoplasty. The faculty must participate as primary surgeon or assistant surgeon to the fellow in a sufficient number of surgical procedures to confirm the fellow's surgical judgment and skill.
4. The fellow should actively participate in the postoperative management in the majority of grafts where they are part of the surgical team.\*\*
5. The fellow should have sufficient experience and demonstrate proficiency with other surgeries, including pterygium excision with graft, corneal and conjunctival biopsies, astigmatic keratotomies, and phototherapeutic keratectomy.\*\*
6. The fellow should participate in the surgery of more complex conditions, including extensive conjunctival reconstruction, amniotic membrane transplantation, ocular surface neoplasia, and limbal stem cell transplantation.\*\*
7. The fellow should have knowledge of different techniques of keratoprosthesis surgery.\*\*
8. The fellow should be familiar with the use of mitomycin (and/or other chemotherapeutic agents) in corneal and conjunctival surgeries and recognize the appropriate application and potential side effects.\*\*

\* \* \*

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## V. Refractive Surgery

### Basic Level Goals: Year 1

#### A. Cognitive Skills

1. Describe simple types of refractive errors: \*\*
  - a. Myopia
  - b. Hyperopia
  - c. Astigmatism
  - d. Presbyopia
2. Describe basic optic principles, such as line of sight and Purkinje image.\*\*
3. Explain theories of accommodation.
4. Describe the basics of ophthalmic optics, including how the following affect the optics of the eye: \*\*
  - a. Low and high order aberrations
  - b. Corneal layers
  - c. Shape of cornea
  - d. Shape of lens
5. Describe basic refraction techniques using trial lenses or phoropter for basic refractive errors, including:
  - a. Retinoscopy
  - b. Modification and refinement of subjective refraction
  - c. Cycloplegic retinoscopy and refraction
  - d. Postcycloplegic refraction
6. Describe the optical principles of common refractive surgery diagnostic tools, including:
  - a. Ultrasonic pachymetry
  - b. Keratometer
  - c. Lensometer
  - d. Pupillometry
  - e. Corneal topography
  - f. Scheimpflug imaging and elevation maps
  - g. Optical coherence tomography (OCT)
7. Describe the following topographic maps using different scales (ie, absolute, normalized, adjustable):
  - a. Axial
  - b. Instantaneous
  - c. Refractive
8. Describe normal corneal topographic patterns, as well as topographic signs of keratoconus and ectasia.
9. Describe elevation topography maps and their importance in screening refractive surgery candidates.
10. Describe indications and limitations of corneal topography in refractive surgery.
11. List the mandatory diagnostic tests necessary for refractive surgery.
12. Describe the basics of laser biophysics and laser tissue interaction.

13. Describe the complications of high myopia, high hyperopia, and pathologies related to high astigmatism.\*\*
  14. Define the clinical stages of keratoconus and forme fruste keratoconus using clinical and topographic tests.\*\*
  15. Describe the milestones in refractive surgery development, including radial keratotomy, keratomileusis, and phakic intraocular lenses (IOLs).
  16. List current refractive procedures, their mechanisms of action, indications, and limitations, including:
    - a. Types of excimer laser procedures
    - b. Phakic IOLs
    - d. Implantation of intracorneal ring segments
    - e. Corneal inlays
    - f. Accommodative lenses
  17. Describe the main IOL calculation formulas.
  18. Describe the principles and different types (ie, linear, rotational, pendular) of mechanical microkeratomes, including their characteristics, indications, risks, and possible complications.
  19. Describe the role of femtosecond technology in refractive surgery, including advantages and limitations of flap creation with a femtosecond laser.
  20. Describe different techniques of keratoplasty and their relation with refractive surgery.
- B. Technical/Surgical Skills
1. Perform objective and subjective refraction, including cross cylinder and Worth 4-dot test. \*\*
  2. Diagnose refractive defects.\*\*
  3. Use different prescription formulas.\*\*
  4. Prescribe spectacles for at least 20 patients with simple refractive errors (eg, myopia, hyperopia, regular astigmatism).\*\*
  5. Perform refraction on patients with extreme errors of refraction (eg, 5 patients with hyperopia over 8.0 D, and 5 patients with myopia above 20.0 D).\*\*
  6. Use the lensometer to measure spectacle power.\*\*
  7. Use the keratometer to make corneal measurements.\*\*
  8. Use the ultrasonic pachymeter to measure corneal thickness.
  9. Validate corneal topography maps, including elevation topography. Recognize signs of ectatic disorders and/or candidates at risk for an unsatisfactory refractive surgery outcome, and rule out poor-quality tests (eg, artifacts, alignment, and corneal exposure issues).
  10. Interpret an aberration map and evaluate its significance in the refractive defect of a patient, as well as the need to treat or not.
  11. Validate a manual refraction as a real refractive defect of a patient, comparing results with keratometers, aberrometers, and topography.
  12. Analyze tear film and tear deficiency.
  13. Recognize and unmask astigmatism from higher order aberrations, such as coma.
  14. Demonstrate how informed consent should be explained.

## **Standard Level Goals: Year 2**

## A. Cognitive Skills

1. Describe various types of refractive defects, and define the possible corrective solutions for each one.\*\*
2. Describe basic diagnostic tools used in refractive surgery, including topography, pachymetry, and biometry; and interpret results.\*\*
3. Describe more complex types of refractive errors, including postoperative refractive errors following cataract surgery, keratoplasty, refractive surgeries, ectatic conditions, and irregular astigmatism.\*\*
4. Explain basics of wavefront analysis, including ray tracing and dynamic skiascopy, and graphical representation of wavefront errors, including corneal and entire eye high-order aberration maps, point-spread function, and modulation-transfer function.
5. Describe the basics of Zernike polynomials and Fourier analysis.
6. Use different topographic maps and scales for different purposes (eg, screening, postoperative evaluation, detection of complications).
7. Describe the basics of measuring contrast sensitivity.
8. Describe laser-tissue interaction and explain Munnerlyn formula.
9. Describe corneal biomechanics, including biomechanical responses to keratorefractive surgery, corneal healing after excimer laser procedures, corneal hysteresis, and corneal resistance factor.
10. Define and diagnose post laser in-situ keratomileusis (LASIK) ectasia, and differentiate it from other conditions.
11. Describe the mechanism of action, indications, advantages, and potential complications of mitomycin C application in surface ablation.
12. Describe the affect of corneal crosslinking on the biomechanical properties of the cornea, including its indications and how it can be combined with other refractive surgery procedures.

## B. Technical/Surgical Skills

1. Perform refraction techniques using trial lenses or phoropter for basic and more complex cases, including:
  - a. Modification and refinement of subjective manifest refractive error
  - b. Cycloplegic retinoscopy and refraction
  - c. Postcycloplegic refraction
  - d. Contact lens use
  - e. Irregular astigmatism
  - f. Postkeratoplasty
  - g. Refractive surgery cases
2. Apply the basics of optics and optical principles of refraction and retinoscopy in the clinical setting, including higher order aberrations.
3. Gather accurate information essential for preoperative evaluation of patients seeking refractive surgery, including:
  - a. Medical interview
    - i. Patient expectation
    - ii. Social history
    - iii. Medical history
    - iv. Pertinent ocular history
  - b. Physical examination



- i. Uncorrected visual acuity
  - ii. manifest and cycloplegic visual acuity
  - iii. Intraocular pressure
  - iv. Slit-lamp examination
  - v. Fundus examination
4. Diagnose and manage dry eye prior to surgery.
5. Use the keratometer to make corneal measurements in more complex patients (eg, prior corneal surgery or corneal disease), and correlate results with corneal topography maps, visual acuity, and quality of vision.
6. Use basic refractive instruments and techniques (eg, auto refractor, pachymetry, automated corneal topography, aberrometer, pupillometry, contact lens refraction, OCT, corneal hysteresis, and corneal resistance factor) in the clinical setting for refractive surgery patients.
7. Assist in developing patient care management plans for simple refractive errors (eg, myopia, hyperopia, regular astigmatism), and define the risks and benefits for each procedure.
8. Assist in various types of refractive surgery, including:
  - a. Twenty surface ablation procedures
  - b. Twenty LASIK procedures
  - c. Ten intracorneal ring segment implantation procedures
  - d. Ten phakic IOL surgeries

### **Advanced Level Goals: Year 3**

#### **A. Cognitive Skills**

1. Describe and diagnose various types of refractive problems, including irregular astigmatism, and identify the best solution for each.\*\*
2. Describe the most complex types of refractive errors, including postoperative refractive errors, postkeratoplasty, and refractive surgery.\*\*
3. Describe the most advanced optics and optical principles of refraction and retinoscopy, including higher-order aberrations.
4. List the indications for and interpret preoperative and postoperative diagnostic testing, including:
  - a. Corneal topography
  - b. Wavefront analysis
  - c. Pachymetry
  - d. Calculation of stromal-bed thickness before and after LASIK
  - e. Aspheric profile of ablation
5. Formulate informed diagnostic and therapeutic decisions based on patient information, current scientific evidence, clinical judgment, and patient expectations.
6. Describe accommodative and nonaccommodative treatments of presbyopia, including:
  - a. Monovision
  - b. Excimer laser correction
  - c. Conductive keratoplasty
  - d. Corneal inlays
  - e. Accommodating IOLs

- f. Multifocal IOLs
  - 7. Describe the advanced formulas for IOL calculation in extreme myopia, hyperopia, and after corneal refractive surgery.
  - 8. Develop patient care management plans for more complex cases (eg, mixed and irregular astigmatism, irregular corneas, combined refractive surgery procedures).
  - 9. Describe the basics of modulation transfer function (MTF), point spread function (PSF), and Strehl ratio as objective ways to measure quality of vision.
  - 10. Describe the basics of topography-guided, wavefront-guided, and optimized ablations as compared to standard ablations.
- B. Technical/Surgical Skills
- 1. Perform basic refractive surgery procedures, such as low myopia or low hyperopia with LASIK (microkeratome) and surface ablation (LASIK or photorefractive keratectomy [PRK]).
  - 2. Perform the most advanced objective and subjective refraction techniques using trial lenses or the phoropter, including:
    - a. Contact lens refraction for more complex refractive errors, including modification and refinement of subjective manifest refractive error
    - b. Cycloplegic retinoscopy and refraction
    - c. Postcycloplegic refraction
    - d. Irregular astigmatism
    - e. Postkeratoplasty
    - f. Refractive surgery cases
  - 3. Utilize the most advanced optics and optical principles for refraction and retinoscopy, including higher order aberrations.
  - 4. Utilize the keratometer for detection of subtle or complex advanced corneal refractive errors.\*\*
  - 5. Use and interpret results from more advanced refraction instruments and techniques (eg, corneal topography, pupillometry, aberrometry, Scheimpflug imaging, OCT).
  - 6. Fit contact lenses in patients with irregular corneas, irregular astigmatism, and following refractive surgery.
  - 7. Assist in advanced refractive surgeries, including topography-guided ablation, wavefront-guided ablation, and combined refractive surgeries.
  - 8. Encourage patients to actively participate in their own care by providing disease and treatment information, and counsel patients on how to prevent postoperative injury.\*\*
  - 9. Correct refractive error after surgeries, such as penetrating keratoplasty, deep anterior lamellar keratoplasty, and radial keratotomy.

### **Very Advanced Level Goals: Subspecialist**

- A. Cognitive Skills
- 1. Diagnose and treat difficult cases such as irregular astigmatism.\*\*
  - 2. Identify and utilize the new technological advances in refractive surgery.\*\*
  - 3. Formulate informed diagnostic and therapeutic decisions based on patient information, current scientific evidence, and clinical judgment:
    - a. Use effective and appropriate clinical problem-solving skills
    - b. Understand the limits of one's knowledge and expertise

- c. Use consultants and referrals appropriately
  - 4. Collect data, analyze refractive outcomes, and develop personal nomograms based on data.
  - 5. Plan for retreatment of patients who had refractive surgery.
  - 6. Develop refractive surgery management plans in the context of other conditions (eg, dry eyes, herpes, keratoconus, postkeratoplasty, glaucoma, retinal disease, amblyopia).
  - 7. Describing methods of IOL calculation after refractive surgery.
- B. Technical/Surgical Skills
- 1. Prescribe and perform procedures essential for the scope of practice.
  - 2. Screen patients for refractive surgery.
  - 3. Develop and carry out patient care management plans.
  - 4. Perform the following, if feasible:
    - a. Twenty surface ablation procedures
    - b. Twenty LASIK procedures
    - c. Ten intracorneal ring segment implantation procedures
    - d. Ten phakic IOL surgeries
  - 5. Perform under supervision 10 advanced refractive surgeries for complicated cases, including excimer laser enhancement procedures and topography-guided ablations for highly irregular corneas.
  - 6. Perform—if feasible—supervised femtosecond refractive surgical procedures, specifically three femto-Lasik procedures and three intracorneal ring segment implantation procedures using a femtosecond laser.
  - 7. Perform—if feasible—supervised corneal crosslinking on five eyes.

\* \* \*

***Note:** Inclusion of therapies and investigations in the ICO Residency Curriculum does not imply that listings are all inclusive or that methods are endorsed by the ICO. Appropriate levels of expertise and knowledge should be achieved based on the care provided. Practitioners should know of therapies and investigations not available at their hospital or clinic, so that they can advise patients who may be able to seek care elsewhere.*

## VI. Glaucoma

### Basic Level Goals: Year 1

#### A. Cognitive Skills

##### *Basic Science*

1. Describe the anatomy of the anterior chamber, angle, and ciliary body.\*\*
2. Describe the anatomy of the retinal nerve fiber layer, optic nerve head, and visual pathway from the retina to the visual cortex.\*\*
3. Describe the mechanisms and dynamics of aqueous humor inflow and outflow.\*\*
4. Describe the microscopic anatomy of the retina from inner to outer portions, with attention to the retinal ganglion cell layer and nerve fiber layer.\*\*
5. Describe the blood supply of the optic nerve and ciliary body.\*\*
6. Describe the apoptotic mechanism of retinal ganglion cell death.\*\*
7. Know the physiology underlying visual-field examination and its interpretation.\*\*
8. Describe the fundamentals of Goldmann static, kinetic perimetry, and standard automated perimetry.\*\*
9. Know basic principles of tonometry and aqueous outflow, and applications of tonometric data (eg, diurnal curve, peak and trough values).\*\*

##### *Clinical Science*

1. Describe the major features of primary open-angle glaucoma (high and low tension), angle-closure glaucoma, glaucoma suspects, and ocular hypertension.\*\*
2. Describe the major risk factors for primary open-angle glaucoma and angle-closure glaucoma.\*\*
3. Describe the steps in evaluating primary open-angle glaucoma and angle-closure glaucoma.\*\*
4. Define glaucoma as a progressive neural degeneration of retinal ganglion cells, their axons and their connections to central visual centers.\*\*
5. Describe the features of glaucomatous optic neuropathy.\*\*
6. Describe the basic features of the major glaucomas: primary open-angle glaucoma, angle-closure glaucoma, exfoliative glaucoma, and pigmentary glaucoma.\*\*
7. Know the role of intraocular pressure (IOP) in the development and progression of glaucoma.\*\*
8. Understand the factors that influence IOP.\*\*
9. Describe and understand basic principles of Goldmann applanation tonometry.\*\*
10. Describe tonometers (eg, Schiøtz, Tono-Pen) and recognize artifacts of testing.\*\*
11. Describe principles and basic techniques of gonioscopy (3 or 4 mirror lenses) to evaluate angle structures.\*\*
12. Describe normal and abnormal angle findings.\*\*
13. Know risk factors other than IOP for primary open-angle glaucoma.\*\*
14. Know subtypes of angle-closure glaucoma (eg, pupillary block, plateau iris, lens-related angle-closure, and malignant glaucoma).\*\*
15. Describe corneal pachymetry and how biomechanics and measurements of corneal thickness affect IOP interpretations.\*\*

16. Understand the principles of indirect ophthalmoscopy to evaluate the optic nerve and retinal nerve fiber layer.\*\*
  17. Describe the most common types of visual field defects in glaucoma.\*\*
  18. Describe principles and mechanisms of medical management of glaucoma.\*\*
  19. Describe major classes of glaucoma medications, their mechanisms of action, indications, contraindications, and side effects (topical and systemic).\*\*
  20. Know drug interactions between systemic drugs and glaucoma drugs.
  21. Know basic medical statistics to interpret major glaucoma studies.
  22. Describe the major results of large prospective clinical trials in addition to those appropriate to the practice region.
    - a. The Glaucoma Laser Trial (GLT)
    - b. The Ocular Hypertension Treatment Study (OHTS)
    - c. The Collaborative Initial Glaucoma Treatment Study (CIGTS)
    - d. The Fluorouracil Filtering Surgery Study (FFSS)
    - e. The Normal Tension Glaucoma Study (NTGS)
    - f. The Advanced Glaucoma Intervention Study (AGIS)
    - g. The European Glaucoma Prevention Study (EGPS)
    - h. The Early Manifest Glaucoma Trial (EMGT)
- B. Technical/Surgical Skills**
1. Take a relevant patient history and recognize the signs and symptoms of glaucoma.\*\*
  2. Perform basic slit-lamp biomicroscopy (including peripheral anterior chamber depth evaluation, Van Herick test).\*\*
  3. Perform basic tonometry (eg, applanation, Schiøtz, Tono-Pen, airpuff).\*\*
  4. When performing basic tonometry, recognize and correct artifacts, and know how to disinfect tonometer and check calibration.
  5. Perform basic gonioscopy with Goldmann-type and indentation lenses.\*\*
  6. Recognize and evaluate angle structures, abnormalities, and appositional and synechial angle closure.\*\*
  7. Perform central corneal pachymetry and relate to IOP findings.
  8. Recognize the common features of the glaucomatous optic nerve including the significance of optic nerve head size, and perform stereo examination, using direct ophthalmoscope, fundus lens, and indirect lenses (ie, 60, 66, 78, or 90 diopter lens).\*\*
  9. Recognize typical features of glaucomatous optic neuropathy (eg, neuroretinal rim changes, disc hemorrhage, peripapillary atrophy).\*\*
  10. Recognize optic nerve features of disorders that cause visual field loss (eg, optic nerve head drusen, optic neuritis).\*\*
  11. Describe slit-lamp findings of secondary glaucomas (eg, iridocorneal endothelial syndrome, pigment dispersion syndrome, exfoliation syndrome, angle recession).\*\*
  12. Interpret visual field results for Goldmann kinetic perimetry and Humphrey or Octopus standard automated perimetry.\*\*
  13. Test for leaking filtering bleb using the Seidel method.\*\*
  14. Be able to test for relative afferent pupillary defect.\*\*
  15. Recognize ocular emergencies of acute angle closure, and blebitis/endophthalmitis.\*\*
  16. Perform paracentesis to lower acute IOP.\*\*

**Standard Level Goals: Year 2**

## A. Cognitive Skills

1. Know epidemiology of congenital glaucoma, primary open-angle glaucoma, exfoliation syndrome and exfoliative glaucoma, and angle-closure glaucoma.
2. Know the genetics of:
  - a. Primary congenital glaucoma (CYP1B1)
  - b. Syndromes associated with congenital/developmental glaucoma
    - i. Lowe syndrome
    - ii. Nail-patella syndrome
    - iii. Aniridia (PAX 6)
    - iv. Axenfeld-Rieger syndrome (PITX2, FOXC1, FKHL7)
  - c. Primary open-angle glaucoma
    - i. GLC1A and the molecular biology of myocilin
    - ii. Optineurin
    - iii. Other genes as they become identified
3. Describe the features of primary infantile and juvenile glaucomas.\*\*
4. Describe etiologies and major risk factors for secondary open-angle glaucomas.\*\*
5. Recognize secondary glaucomas (eg, angle recession, inflammatory, steroid induced, pigmentary, exfoliative, phacolytic, neovascular, postoperative, malignant, lens-particle glaucomas, plateau iris, glaucomatocyclitic crisis, iridocorneal endothelial syndrome) with attention to appropriate pathophysiology.\*\*
6. Describe the evaluation and treatment of complex secondary glaucomas (eg, exfoliation, angle recession, inflammatory, steroid induced, pigmentary, phacolytic, neovascular, postoperative, malignant, lens-particle glaucomas; plateau iris; glaucomatocyclitic crisis; iridocorneal endothelial syndromes; aqueous misdirection/ciliary block).\*\*
7. Describe diurnal fluctuations in IOP and ocular perfusion pressure and their application in the approach to therapy.\*\*
8. Recognize and describe more advanced optic nerve and nerve fiber layer anatomy in glaucoma and typical and atypical features associated with glaucomatous cupping (eg, rim pallor, disc hemorrhage, parapapillary atrophy, rim thinning, notching, circumlinear vessels, central acuity loss, hemianopic or other nonglaucomatous types of visual field loss).\*\*
9. Describe tools and techniques for quantitative anterior segment imaging such as ultrasound biomicroscopy and anterior segment optical coherence tomography (OCT).\*\*
10. Describe basic principles of tools to analyze optic nerve and retinal nerve fiber layer such as OCT, Heidelberg Retina Tomograph (HRT), and GDx.\*\*
11. Interpret HRT, OCT, and GDx scans.\*\*
12. Describe and interpret more advanced forms of perimetry (kinetic and automated static), including various perimetry strategies such as threshold testing, suprathreshold testing, and special algorithms.\*\*
13. Describe the principles involved in determining glaucomatous progression both clinically and perimetrically.\*\*
14. Describe the principles, and more advanced anatomic gonioscopic features of primary and secondary glaucomas (eg, plateau iris, appositional closure).\*\*
15. Describe target IOP and its use in glaucoma management.\*\*

16. Describe the principles of medical management of more advanced glaucomas (eg, advanced primary open-angle glaucoma, secondary open and closed angle glaucomas, normal tension glaucoma).\*\*
  17. Describe pitfalls of medical treatment, in particular poor compliance and adherence.\*\*
  18. Describe and recognize the features of angle-closure glaucomas and aqueous misdirection.\*\*
  19. Describe the most common clinical features and etiologies of ocular hypotony.\*\*
  20. Describe differential diagnosis and management of hypotony.\*\*
  21. Describe and know how to apply the results of major clinical trials in glaucoma to clinical practice (eg, GLT, OHTS, CIGTS, FFSS, NTGS, AGIS, EGPS, EMGT).
  22. Describe and apply specific medical treatments in more advanced glaucoma.\*\*
  23. Describe the principles, indications, and techniques of various types of laser energy, spot size, and laser wavelengths.
  24. Describe the principles, indications, and techniques of trabeculectomy (with or without cataract surgery, with or without antimetabolites), glaucoma drainage devices, and cyclodestructive procedures.\*\*
  25. Describe the major etiologies of dislocated or subluxated lens associated with glaucoma (eg, trauma, Marfan syndrome, homocystinuria, Weill-Marchesani syndrome, syphilis).
  26. Describe the less common causes of lens abnormalities associated with glaucoma (eg, spherophakia, lenticonus, ectopia lentis).
  27. Define the relationships of glaucoma and uveitis.\*\*
  28. Describe diagnostic accuracy, false positive and false negative diagnoses and their significance at individual and societal levels, differences between case-based and community-based screening, including an understanding of sensitivity and specificity, number needed to treat, *t* tests, life-table analysis, prospective versus retrospective studies, case control and cohort studies.
- B. Technical/Surgical Skills
1. Select appropriate drugs and be able to customize or modify medical treatment for open-angle, secondary, and angle-closure glaucomas.\*\*
  2. Perform argon and selective laser trabeculoplasty for open-angle glaucoma.\*\*
  3. Perform argon or YAG laser for angle-closure glaucoma.\*\*
  4. Perform surgical peripheral irido(ec)tomy for angle-closure glaucoma.
  5. Perform peripheral iridoplasty for nonpupillary block angle-closure glaucoma.\*\*
  6. Perform laser suture lysis.\*\*
  7. Perform cyclodestructive surgery (photocoagulation or cryotherapy).\*\*
  8. Assist with trabeculectomy and glaucoma drainage device surgery in the operating room.\*\*
  9. Describe and manage a flat anterior chamber.\*\*
  10. Perform routine trabeculectomy.\*\*

### **Advanced Level Goals: Year 3**

#### A. Cognitive Skills

1. Describe the etiology, pathophysiology, and clinical characteristics of the most complex glaucomas (eg, angle recession, multimechanism glaucoma, traumatic glaucoma, neovascular, uveitic glaucoma, iridocorneal endothelial syndrome).\*\*

2. Identify the key examination techniques and management of complex medical and surgical problems in glaucoma (eg, complicated or postoperative primary and secondary open-angle and closed-angle glaucoma, uncommon visual field defects).\*\*
3. Apply in clinical practice tonometric methods (eg, diurnal curve) in complicated or atypical cases of glaucoma, advanced tonometric methods, and the effect of central corneal thickness (pachymetry) on IOP readings.\*\*
4. Apply in clinical practice tonometric methods, such as PASCAL tonometer, pneumotonometry, and rebound tonometry (ICare).
5. Apply the most advanced knowledge of optic nerve and nerve fiber layer anatomy and describe and interpret techniques, methods, and tools for analyzing the nerve fiber layer.\*\*
6. Recognize and evaluate atypical or multifactorial glaucomatous cupping (eg, rim pallor) and when to order additional tests to rule out other pathologies (eg, magnetic resonance imaging, computerized tomography scan, carotid Doppler).\*\*
7. Know how to diagnose progression using special software available with optic nerve and retinal measurement technologies and know the errors and limitations of the instruments.\*\*
8. Describe, interpret, and apply the results of the most complex and advanced forms of perimetry, including special kinetic and automated static perimetry strategies (eg, special algorithms) in atypical or multifactorial glaucoma.
9. Describe visual field damage, progression, rate of progression, caveats, and their use in glaucoma management.\*\*
10. Describe medical management of the most advanced and complex glaucoma (eg, advanced primary open-angle glaucoma previously treated with medicine, laser, or surgery; secondary glaucomas).\*\*
11. Describe, recognize, and know how to treat the most advanced cases of primary open-angle glaucoma (eg, monocular patients, repeat surgical cases), normal tension glaucoma, and secondary glaucomas (eg, inflammatory glaucoma, angle recession).\*\*
12. Describe, recognize, and know how to treat primary angle-closure glaucoma and complex glaucomas (eg, postoperative cases, secondary angle closure, aqueous misdirection).\*\*
13. Describe the clinical features of ocular hypotony, recognize and know how to treat common and uncommon etiologies (eg, choroidal detachment, leaking trabeculectomy bleb).\*\*
14. Describe the results, apply the conclusions, and critically analyze the major clinical trials in glaucoma (eg, GLT, OHTS, CIGTS, FFSS, NTGS, AGIS, EGPS, EMGT), as well as describe and use other publications in the management of glaucoma patients.\*\*
15. Describe the features of and know how to evaluate and treat or when to refer the primary infantile, developmental (eg, aniridia, Axenfeld-Rieger), and juvenile glaucomas.\*\*
16. Describe and know how to apply specific medical treatments in advanced glaucoma cases.\*\*
17. Describe the principles, indications, and complications of laser treatment of more advanced or complex glaucoma (eg, repeat procedures).\*\*
18. Describe the more advanced surgical treatment of glaucoma: (eg, trabeculectomy, combined cataract and trabeculectomy, glaucoma drainage devices, and cyclodestructive procedures), including indications, techniques, and complications.\*\*



19. Describe use of antimetabolites and antiangiogenic agents and potential complications from their use.\*\*
20. Recognize glaucoma surgical complications, their etiologies, and options for treatment.\*\*
21. Describe and treat intraocular infections resulting from filtering blebs or other glaucoma procedures.\*\*
22. Describe new nonpenetrating glaucoma surgery techniques: principles, techniques, advantages, limitations, and complications.\*\*
23. Describe new microsurgical devices (eg, EX-PRESS, iStent, gold shunt, Trabectome) used in glaucoma surgery.

#### B. Technical/Surgical Skills

1. Perform YAG or argon laser procedures in glaucoma patients (eg, monocular patient, repeat laser, vitreolysis, suture lysis).
2. Perform laser peripheral iridotomy for more advanced glaucoma (eg, monocular patient, acute angle closure, hazy cornea).
3. Perform laser treatments (eg, argon laser trabeculoplasty, iridoplasty) for more advanced glaucoma cases (eg, repeat treatments, monocular patient).
4. Perform cyclophotocoagulation for more advanced cases (eg, prior surgery, monocular patient).
5. Perform routine and repeat trabeculectomy with or without antimetabolites.
6. Manage and treat an anterior chamber as appropriate.
7. Manage and treat medically and/or surgically a flat anterior chamber as appropriate.
8. Perform small incision phaco/intraocular lens surgery combined with trabeculectomy, at the same or different sites.

### **Very Advanced Level Goals: Subspecialist**

*Subspecialist equivalent: a glaucoma subspecialist must be able to perform flawless gonioscopy; interpret the most difficult discs; diagnose and treat unusual and rare glaucomas; devise management algorithms throughout care, foreseeing alternatives and potential complications; perform surgery and manage complications of surgery in high-risk glaucoma cases; prepare a thorough consultation letter with instructions for management and future potential difficulties; and teach these skills to residents and general ophthalmologists.\*\**

#### A. Cognitive Skills

1. List the main population-based studies in glaucoma prevalence, incidence, and risk factors (eg, Baltimore Eye Survey, Blue Mountains Eye Study, Barbados Eye Study, Rotterdam Eye Study, Thessaloniki Eye Study, Latinos Eye Study, Singapore Malay Eye Study).
2. Describe and critically discuss results of the above-mentioned studies on glaucoma prevalence, incidence, and risk factors.
3. Describe rate of progression and use of special algorithms (eg, value function iteration, PROGRESSOR, Garway-Heath map).\*\*
4. Describe and critically discuss literature on structure-function correlation.\*\*
6. Describe use of other tonometers (eg, ocular response analyzer, dynamic contour tonometry, pneumotonometer).\*\*
7. Describe mechanisms of ganglion cell damage and potential pathways for neuroprotection.\*\*

8. Describe and know specific medical and surgical treatments in the most complex and most advanced glaucoma cases (eg, refractory glaucoma, monocular patients, noncompliant patients).\*\*
9. Describe and know the specific management of complications related to the surgical intervention of the most complex and most advanced glaucomas.\*\*

B. Technical/Surgical Skills

1. Perform goniotomy, trabeculotomy, and manage complications.\*\*
2. Medical and surgical management of hypotony from overfiltration, bleb leak, choroidals, and other causes.\*\*
3. Treat malignant glaucoma and manage complications.\*\*
4. Treat failing or leaking blebs at slit lamp and manage complications.\*\*
5. Perform advanced techniques for revisions of glaucoma surgery blebs (eg, sliding flap, free graft, amniotic membrane) and manage complications.\*\*
6. Perform cyclodestructive procedures and manage complications.\*\*
7. Perform trabeculectomy revisions, glaucoma drainage device surgery, and manage complications.\*\*
8. Describe and manage cyclodialysis cleft.
9. Perform releasable suture techniques.\*\*
10. Perform choroidal drainage.\*\*
11. Perform phacotrabeculectomy/combined surgery and manage surgical complications.\*\*
12. Perform laser trabeculoplasty and manage surgical complications.\*\*
13. Manage end stage and high risk glaucomas.\*\*
14. Perform combined implant/phaco/penetrating keratoplasty/vitreotomy.\*\*

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## VII. Neuro-Ophthalmology

### Basic Level Goals: Year 1

#### A. Cognitive Skills

1. Describe the neuroanatomy of the visual pathways.\*\*
2. Describe the anatomy and functions of cranial nerves 2-8.\*\*
3. Describe the anatomy of the bony orbit.
4. Describe the pupillary and accommodative neuroanatomy.\*\*
5. Describe ocular motility and related neuronal pathways.\*\*
6. Describe the typical features, evaluation, and management of the most common optic neuropathies (eg, infectious, demyelinating, ischemic, inflammatory, hereditary, toxic, nutritional, compressive, infiltrative).\*\*
7. Describe the typical features, evaluation, and management of the most common ocular motor neuropathies (eg, third, fourth, sixth nerve palsy).\*\*
8. Describe the typical features of cavernous sinus syndrome and superior orbital fissure syndrome.
9. Describe and distinguish congenital nystagmus versus acquired nystagmus.
10. Describe the typical features, evaluation, and management of the most common efferent pupillary abnormalities (eg, Horner syndrome, third nerve palsy, tonic pupil, light-near dissociation).\*\*
11. Describe the typical features and evaluation of the most common visual field defects (eg, optic nerve, optic chiasm, optic radiation, occipital cortex).\*\*
12. Describe the clinical features and evaluation of ocular myasthenia gravis.
13. Describe the clinical features and evaluation of carotid-cavernous fistula.
14. Describe the differential diagnosis, evaluation, and management of congenital optic nerve abnormalities (eg, optic pit, disc coloboma, papillorenal syndrome, morning glory syndrome, tilted disc, optic nerve hypoplasia, myelinated nerve fiber layer, melanocytoma, disc drusen, Bergmeister papilla).
15. Describe the features of simple supranuclear and internuclear palsies (eg, internuclear ophthalmoplegia, vertical gaze palsy).
16. Describe the signs of nonorganic visual loss.
17. Describe the indications for obtaining neuroimaging studies, including computerized tomography (CT) scanning, magnetic resonance imaging (MRI), orbital ultrasonography, and catheter angiography.
18. Describe the signs and symptoms of giant cell arteritis and the indications for performing a temporal artery biopsy.\*\*
19. Describe the clinical features, evaluation and neuro-ophthalmic aspects of thyroid ophthalmopathy.\*\*
20. Describe a systematic, sign-and-symptom-oriented neuro-ophthalmic patient interrogation (ie, history taking) and recording techniques.\*\*
21. Describe features of common headache and facial pain syndromes (eg, migraine, trigeminal neuralgia).

#### B. Technical/Surgical Skills

1. Perform basic visual function tests (eg, color vision testing, Amsler grid, photostress test, contrast sensitivity testing).\*\*
2. Perform tests of binocularity and fusion (eg, polarized Titmus stereo test, Worth 4-dot test).\*\*
3. Perform a basic pupillary examination.\*\*
4. Describe indications for and perform basic pharmacologic pupillary testing for Horner syndrome, pharmacologic dilation, and tonic pupil.\*\*
5. Describe and detect a relative afferent pupillary defect.\*\*
6. Detect light-near dissociation
7. Perform a basic assessment of ocular alignment.\*\*
8. Use simple observational techniques (eg, Hirschberg test, Krimsky method).\*\*
9. Describe and perform basic cover/uncover testing for tropia.\*\*
10. Describe and perform alternate cover testing for phoria.\*\*
11. Perform simultaneous prism and cover testing.\*\*
12. Perform measurement of deviations with prisms.\*\*
13. Describe the indications for and apply Fresnel and grind-in prisms.
14. Describe the indications for and in a clinical setting perform forced duction and forced generation testing.
15. Perform a complete evaluation of the major ocular motor systems (eg, fixation, pursuit, saccades, convergence, vestibuloocular reflex).
16. Perform an evaluation of eyelids (eg, assess lid position, measure palpebral fissure, quantify levator function).\*\*
17. List the indications for visual field testing and interpret standard clinical perimetry programs.\*\*
18. Perform confrontational field testing (eg, static and kinetic, central and peripheral, red and white targets).\*\*
19. Describe the indications for and perform basic kinetic perimetry and interpret results.\*\*
20. Describe the indications for and perform basic automated perimetry and interpret results.
21. Describe the format of standard clinical tests (eg, light stimulus, background illumination, test points).\*\*
22. Perform basic direct, indirect, and magnified ophthalmoscopy examination of the optic disc, macula, vessels, and periphery of the retina (eg, recognize optic disc swelling, optic atrophy, neuroretinitis, nerve head vascular abnormalities, and macular abnormalities, such as edema, pigmentary changes, subretinal fluid, vessel abnormalities, pigmentary changes) and use the findings to generate a differential diagnosis.\*\*
23. Describe the anatomy and indications for CT, MRI, and angiography.\*\*
24. Describe the indications for and interpret basic echography (ultrasound) of the orbits.
25. Perform exophthalmometry.
26. Check pulse, blood pressure in both arms, carotid bruit, and heart sounds.

### **Standard Level Goals: Year 2**

*Describe the neuro-ophthalmic anatomy and physiology (ie, the orbit and adnexal structures, the afferent and efferent visual pathways with their intracranial projections, the sensory and motor anatomy of the face, and the autonomic nervous system, including their blood supplies) as it applies to the eye and visual system.*

## A. Cognitive Skills

1. Describe typical and atypical features, evaluation, and management of the most common optic neuropathies (eg, papilledema, optic neuritis, ischemic, inflammatory, infectious, infiltrative, compressive, hereditary optic neuropathies).\*\*
2. Describe features, evaluation, and management of the more complex supranuclear and internuclear palsies (eg, progressive supranuclear palsy and subtle internuclear ophthalmoplegia, one-and-half syndrome).
3. List the common causes of an acute versus chronic isolated ocular motor neuropathy and define general management of each.\*\*
4. List the common causes of cavernous sinus syndrome and superior orbital fissure syndrome.\*\*
5. Describe and differentiate among different forms of acquired nystagmus (eg, downbeat, upbeat, pendular, gaze evoked, rebound, convergence, retraction).\*\*
6. List the different mechanism causing nonphysiologic anisocoria and describe characteristics features and evaluation of the less common disorders (eg, mixed sympathetic and parasympathetic denervation of iris, aberrant regeneration in third nerve palsy, pharmacologic miosis).
7. List mechanism and causes of central versus peripheral light near dissociation (eg, Argyll-Robertson pupil, diabetic neuropathy, tonic pupil, Parinaud syndrome).
8. Describe features and evaluation of the less commonly encountered visual field defects (eg, sectoranopia, checkerboard, monocular temporal crescent).
9. Describe more advanced aspects of visual field testing indications, selection, and interpretation (eg, artifacts of automated perimetry, testing, and thresholding strategies).
10. Describe neuro-ophthalmic aspects of common systemic diseases (eg, hypertension, diabetes, thyroid disease, myasthenia gravis, temporal arteritis, sarcoidosis, systemic infections, inflammation).\*\*
11. Describe neuro-ophthalmic findings that are common following head trauma (eg, traumatic optic neuropathy, bilateral fourth nerve palsy, traumatic brain injury).\*\*
12. Describe evaluation and management of inherited neuro-ophthalmic diseases (eg, Leber hereditary optic neuropathy, autosomal dominant optic atrophy, spinocerebellar degenerations).\*\*
13. Describe evaluation and management of ocular myasthenia gravis.\*\*
14. Recognize common pathologic findings of brain and orbits on CT and MRI related to neuro-ophthalmology.\*\*
15. Describe the typical features, evaluation, and management of urgent neuro-ophthalmic pathologies (eg, giant cell arteritis, cavernous sinus thrombosis, orbital apex syndrome, pituitary apoplexy).\*\*

## B. Technical Skills

1. Describe the indications for intravenous edrophonium (ie, Tensilon) and prostigmin tests for myasthenia gravis.\*\*
2. Perform a detailed cranial nerve evaluation other than the oculomotor nerve evaluation (eg, trigeminal, and facial and acoustic nerve function).
3. Describe the interpretation of neuro-radiologic images (eg, indications and interpretation of orbital tumors, thyroid eye disease, pituitary adenoma, optic nerve glioma, optic nerve sheath meningioma).

4. Describe the evaluation, management, and specific testing (eg, stereopsis, mirror test, red-green testing, monocular prism test) of patients with “functional” (ie, nonorganic) visual loss (eg, recognize nonorganic spiral or tunnel visual fields).\*\*
5. Describe the indications for, perform, and list the complications of temporal artery biopsy.
6. Perform and interpret basic ocular coherence tomography (OCT) imaging of the eye (eg, optic disc, retinal nerve fiber layer, macula).\*\*
7. Describe the indications and interpret basic ocular electrophysiology (eg, visually-evoked potential [VEP], electroretinogram [ERG], electrooculogram [EOG]).
8. Perform basic neurologic screening examination (eg, tandem walk, sensory examination, cerebellar function testing, basic cognitive evaluation).
9. Identify patients with “functional” visual loss (ie, nonorganic visual loss) and provide appropriate approach and follow up.\*\*
10. Quantify relative afferent pupillary defect (RAPD) with neutral density filter and be able to detect RAPD in patients with only one working pupil.\*\*
11. Interpret fluorescein angiography images.

### **Advanced Level Goals: Year 3**

#### **A. Cognitive Skills**

1. Describe the typical and atypical features, evaluation, and management of papilledema and raised intracranial pressure due to a variety of causes (eg, sinus thrombosis, idiopathic, meningitis).\*\*
2. Describe the typical features, evaluation, and management of urgent neuro-ophthalmic pathologies (eg, giant cell arteritis, cavernous sinus thrombosis, orbital apex syndrome, pituitary apoplexy).\*\*
3. Describe typical features of the most advanced and least common optic neuropathies (eg, chronic recurrent inflammatory optic neuritis, posterior ischemic optic neuropathy, neuromyelitis optica, autoimmune optic neuropathy, toxic/nutritional).\*\*
4. Describe typical and atypical features, evaluation, and management of the most complex and least common ocular motor neuropathies and their mimics (eg, patterns of aberrant regeneration).
5. Describe typical and atypical features, evaluation, and management of the most complex and least common forms of nystagmus (eg, spasmus nutans, see-saw nystagmus, periodic alternating nystagmus).
6. Describe typical and atypical features, evaluation, and management of the most advanced and least common pupillary abnormalities (eg, pupil findings in coma, transient pupillary phenomenon).
7. Describe features, evaluation, and management of the most complex and least common visual field defects and recognize pattern mimics (eg, combination of disc-related scotoma plus hemianopia, binasal hemianopia, sectoranopia, bilateral inferior altitudinal loss due to superior occipital lobe lesions and not bilateral anterior ischemic optic neuropathy).\*\*
8. Describe, evaluate, and treat the neuro-ophthalmic aspects of systemic diseases (eg, malignant hypertension, diabetic papillopathy, toxicity of systemic medications, paraneoplastic syndromes, HIV/AIDS).\*\*

9. Describe, evaluate, and treat the neuro-ophthalmic manifestations of trauma (eg, corticosteroid or surgical therapy in traumatic optic neuropathy).
  10. Describe, evaluate, and provide appropriate genetic counseling for inherited neuro-ophthalmic diseases (eg, hereditary optic neuropathies, chronic progressive external ophthalmoplegia, neurofibromatosis, ataxia syndromes).
  11. Recognize, evaluate, and treat transient monocular visual loss.\*\*
  12. Describe indications and interpret blood test results for various systemic disorders with neuro-ophthalmic manifestations (eg, thyroid disorders, pituitary disorders, myasthenia graves).
  13. Describe syndromes of cortical visual dysfunction.
  14. Detect early neuro-ophthalmic signs and symptoms of drug toxicity for commonly used medications.
  15. Describe the neuro-ophthalmic complications related to pregnancy.
- B. Technical/Surgical Skills
1. Perform and interpret the results of the intravenous edrophonium (ie, Tensilon) and prostigmin tests for myasthenia gravis; recognize and treat the complications of the procedures.\*\*
  2. Perform and interpret the complete cranial nerve evaluation in the context of neuro-ophthalmic localization and diseases.\*\*
  3. Interpret neuro-radiologic images in neuro-ophthalmology (eg, interpretation of orbital imaging for orbital pseudotumor and tumors, thyroid eye disease, intracranial imaging modalities and strategies for tumors, aneurysms, infection, inflammation, ischemia), and appropriately discuss, in advance of testing, the localizing clinicoradiological features with the neuroradiologist in order to obtain the best study and interpretation of the results.\*\*
  4. Identify patients with “functional” visual loss (ie, nonorganic visual loss) and provide appropriate counseling and follow-up.\*\*
  5. Quantify RAPD with neutral density filter and detect small RAPD in patients with only one working pupil.\*\*
  6. Perform optic nerve sheath decompression, if trained, for papilledema.\*\*
  7. Perform neuro-ophthalmic evaluations for people with special needs (eg, comatose patients, children, children with developmental and visual maturation evaluations).
  8. Describe indications, dose, and administration of Botox for neuro-ophthalmic disorders (eg, hemifacial spasm, blepharospasm, paralytic strabismus).

### **Very Advanced Level Goals: Subspecialist**

- A. Cognitive Skills
1. Describe the arterial circulation in detail and know the general venous drainage along the entire anterior visual pathway (eg, optic disc, retrobulbar optic nerve, intracranial segment of optic nerve, chiasm, lateral geniculate body).
  2. Describe evaluation, give differential diagnosis, and outline a management plan of the most advanced and least common optic neuropathies (eg, chronic recurrent inflammatory optic neuritis, posterior ischemic optic neuropathy, neuromyelitis optica, autoimmune optic neuropathy, rare toxic optic neuropathies).\*\*

3. Describe the cortical visual syndromes and know the localization of the causative lesion (eg, akinetopsia, prosopagnosia, simultagnosia).
4. Be able to discuss strengths and weaknesses of current treatment options (eg, steroids for acute nonarteritic anterior ischemic optic neuropathy, hyperbaric oxygen treatment, neuromyelitis optica antibodies in optic neuritis).\*\*
5. Describe typical and atypical features, evaluation, and management of rare eye movement disorders (eg, differential diagnosis of monocular oscillations, localization of lesion and purported mechanism of oculopalatal myoclonus).
6. Describe typical features, pathophysiology, evaluation, and management of rare pupillary syndromes (eg, tadpole pupil, paradoxical pupillary constriction).
7. Describe the advantages, disadvantages, indications, and pitfalls in special perimetric methods (eg, blue-yellow perimetry, automated kinetic perimetry, motion perimetry, microperimetry).
8. Describe and differentiate among various kinds of unusual positive visual phenomena and know their possible causes (eg, palinopsia, persistent photopsia).\*\*
9. Know the differential diagnosis and evaluation for acute or progressive homonymous hemianopsia in a patient with a normal MRI.\*\*
10. Describe the various prion diseases and their management.
11. Describe the various mitochondrial syndromes that have neuro-ophthalmic manifestations, and provide appropriate genetic counseling for inherited neuro-ophthalmic diseases (eg, Kearns-Sayre and related syndromes, mitochondrial encephalomyopathy, lactic acidosis, stroke-like episodes [MELAS], neuropathy, ataxia, and retinitis pigmentosa [NARP]).\*\*
12. Describe evaluation, give differential diagnosis, and outline a management plan for patients with headache and facial pain presenting as neuro-ophthalmic manifestations.\*\*
13. Describe the features, evaluation, and differential diagnosis of dizziness and vertigo from neuro-ophthalmic problems.\*\*

#### B. Technical/Surgical Skills

1. Recognize pitfalls in interpretations of unusual results of pharmacologic tests used for diagnosis of pupillary disorders.\*\*
2. Know techniques that reveal the most subtle manifestations of eye movement disorder (eg, slow medial rectus saccade as the only sign of internuclear ophthalmoplegia, fundus photos for excyclotorsion, head shaking test).\*\*
3. Perform and interpret the complete neurologic examination.
4. Be able to detect symptomatic lesions overlooked by the neuroradiologist (eg, small lesion in optic canal, carotid dissection).\*\*
5. Be able to perform specific maneuvers that definitively reveal nonorganic visual loss or overlay (eg, 4-diopter prism test, rocking mirror).\*\*
6. Perform and interpret spectral-domain OCT (eg, outer retinal disorders, detection of drusen).
7. Describe the indications and interpret laboratory results for seromarkers, antibodies, and antigen levels for various systemic diseases with neuro-ophthalmic manifestations (eg, paraneoplastic syndromes, autoimmune disease, inflammatory disorders).\*\*
8. Interpret indocyanine green angiography and autofluorescence imaging.

\* \* \*



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## **VIII. Ophthalmic Pathology**

### **Overview**

Ophthalmic pathology has greatly advanced the ophthalmologist's understanding of the origin, diagnosis, treatment, and prognosis of diseases of the eye and its adnexa, since the integration of this discipline into residency training approximately a century ago. The International Council of Ophthalmology emphasizes the continued importance of ophthalmic pathology to training of ophthalmologists. It distinguishes ophthalmology as a medical specialty, which is based on the understanding of the pathological basis of eye diseases. Ophthalmic surgery can be regarded as applied ophthalmic pathology. The major contributions of ophthalmic pathology are of particular interest to ophthalmology.

All residents should be engaged with an ophthalmic pathologist who ideally practices within or with appointment to the ophthalmology department and who can practice either ophthalmology or pathology in addition to providing the ophthalmic pathology service.

At least one residency program in each country should aim to maintain an ophthalmic pathology laboratory or be affiliated with an ophthalmic pathology laboratory, which permits ophthalmology residents with a special interest in ophthalmic pathology opportunity to participate in grossing, sectioning, and processing of specimens, as well as related research. Other programs should aim to collaborate with the national or regional ophthalmic pathology laboratory, or with an extramural pathologist who works with the faculty and staff in the ophthalmology department, to develop expertise in ophthalmic pathology. Residents should have access to ophthalmic pathology workshops or teleconferences to complete the curriculum requirements.

### **Standard Level Goals**

The principal aim is to link ophthalmic pathology with specific patient-based areas of residency training (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology). The subspecialties emphasized should vary according to the prevalence of ophthalmic disease and the particular expertise of the ophthalmology department and associated ophthalmic pathology laboratory.

Teaching can be conducted through regular face-to-face consultation sessions or clinicopathologic conferences. During their training, residents should get a minimum of 36 hours (ie, 1 hour per month) of experience in evaluating pathological specimens with a specialist who has expertise in ophthalmic pathology.

Teaching clinicopathologic correlations can be supplemented with demonstrations through advanced imaging techniques (eg, ultrasonography, optical coherence tomography, magnetic resonance imaging), which produce images that are similar to gross pathologic specimens and histopathologic sections and have the ability to differentiate pathologic processes.

### **Advanced Level Goals**

Chairs in ophthalmology should provide residents with a special interest in ophthalmic pathology the opportunity to participate in grossing, sectioning, processing, and examination of specimens.

### **Very Advanced Level Goals**

Chairs in both ophthalmology and pathology need to identify promising residents to receive special training and to work with the clinical faculty and laboratory staff to develop subspecialty expertise in ophthalmic pathology.

\* \* \*

### **Basic Level Goals: Year 1**

*These goals are pertinent from the beginning of ophthalmology residency and should typically be acquired during the first year of ophthalmic residency training.*

#### **A. Cognitive Skills**

1. Describe the professional duties and specific and unique aspects of professionalism of ophthalmic pathology, and the significance of ophthalmic pathology to the practice of ophthalmology.\*\*
2. Describe basic ocular anatomy and histology of the major structures of the eye and its adnexa:
  - a. Conjunctiva\*\*
  - b. Cornea\*\*
  - c. Sclera\*\*
  - d. Anterior chamber\*\*
  - e. Posterior chamber\*\*
  - f. Iris\*\*
  - g. Ciliary body\*\*
  - h. Lens\*\*
  - i. Vitreous\*\*
  - j. Retina and retinal pigment epithelium\*\*
  - k. Choroid\*\*
  - l. Optic nerve\*\*
  - m. Visual pathway\*\*
  - n. Eyelids\*\*
  - o. Extraocular muscles\*\*
  - p. Lacrimal system\*\*
  - q. Orbit\*\*
3. Describe basic pathophysiology of the common disease processes of the eye and its adnexa, and identify the major histologic findings:
  - a. Degeneration (eg, pterygium, keratoconus)\*\*
  - b. Dystrophy (eg, Fuchs dystrophy, TGFBI-associated dystrophies)\*\*
  - c. Infection (eg, fungal keratitis, bacterial endophthalmitis)\*\*
  - d. Inflammation (eg, chalazion, idiopathic orbital inflammation)\*\*
  - e. Neoplasm and proliferation (eg, basal and squamous cell carcinoma, uveal melanoma, retinoblastoma)\*\*

4. Describe common methods of specimen acquisition and handling for ophthalmic pathology, especially handling methods that avoid artifacts and ensure representative sampling:
    - a. Surgical biopsy, with special emphasis on the eyelids and conjunctiva, cornea, and vitreous\*\*
    - b. Resection margin marking\*\*
    - c. Enucleation\*\*
    - d. Exenteration\*\*
    - e. Impression cytology
    - f. Fine needle aspiration biopsy
  5. Describe basic information necessary to communicate to the ophthalmic pathologist regarding study of these specimens.\*\*
  6. Describe common indications for frozen sections in ophthalmic pathology (eg, complete resection margins in basal and squamous cell carcinoma, demonstration of lipid in sebaceous gland carcinoma).\*\*
  7. Describe basic steps in handling and processing of gross specimens in the ophthalmic pathology laboratory through a site visit, with relevance to ophthalmic surgery.
- B. Technical/Surgical Skills
1. Process specimens for submitting to an ophthalmic pathology laboratory, and write the accompanying letter to the ophthalmic pathologist (eg, surgical biopsy, corneal button, enucleated eye, exenteration specimen).\*\*
  2. Read and interpret reports from these specimens written by the ophthalmic pathologist.\*\*
  3. Participate as an observer through a site visit in the macroscopic and microscopic examination of ophthalmic pathology specimens from active cases.

### **Standard Level Goals: Year 2 and Year 3**

*These goals relate to the second and third years of ophthalmic residency training.*

#### A. Cognitive Skills

1. Describe more advanced ocular anatomy (eg, common variants), and identify the histology of the major structures of the eye and its adnexa relevant to specific clinical rotation(s) (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology).\*\*
2. Describe the pathophysiology and identify the major histologic findings of common diseases of the eye (eg, keratitis, exfoliation syndrome, corneal and retinal dystrophies and degenerations, frequent neoplasms) relevant to specific clinical rotation(s) (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology).\*\*
3. Describe the pathophysiology and histology of potentially vision or life-threatening diseases (eg, temporal arteritis, endophthalmitis, retinoblastoma, ocular melanoma, extraocular or orbital spread of an intraocular or periorbital tumor, metastasis to the eye and orbit) relevant to specific clinical rotation(s) (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology).\*\*
4. Describe and interpret reports of more advanced techniques in ophthalmic histopathology (eg, cytology, special stains, transmission electron microscopy, immunohistochemistry, tumor free margins) relevant to specific clinical rotation(s) (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology), including how the clinician communicates the need for these studies.\*\*

## B. Technical/Surgical Skills

1. Process appropriately more advanced specimens for submitting to an ophthalmic pathology laboratory, including writing of the accompanying letter to the ophthalmic pathologist (eg, impression cytology, fine needle aspiration biopsy, vitreous biopsy, evisceration, exenteration specimen).\*\*
2. Perform and submit a biopsy for frozen section study in ocular pathology.\*\*
3. Participate under supervision through a site visit in a macroscopic and microscopic examination of ophthalmic specimens from active cases, working from low to high power.

## **Advanced Level Goals: Year 2 and Year 3**

*These goals relate to the second and third years of ophthalmic residency training, for residents with a special interest in ophthalmic pathology.*

### A. Cognitive Skills

1. Describe less common ocular anatomy (eg, pars plana cysts), and identify the histology of the minor structures (eg, ciliary sulcus) of the eye and its adnexa relevant to specific clinical rotation(s) (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology).\*\*
2. Describe the pathophysiology of less common disease processes of the eye (eg, most common syndromes, less common corneal and retinal dystrophies and degenerations and ocular neoplasms, ocular lesions in acquired immune deficiency syndrome) relevant to specific clinical rotation(s) (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology), and identify their major histologic findings.\*\*
3. Describe and interpret reports of advanced techniques in ophthalmic pathology (eg, flow cytometry, molecular genetics) relevant to specific clinical rotation(s) (eg, oculoplastics, cornea, glaucoma, retina, ophthalmic oncology).\*\*

### B. Technical/Surgical Skills

1. Participate as an “at-the-elbow” observer during microscopic examination of active ophthalmology cases, including special stains.\*\*
2. Participate in gross examination and cutting of common ophthalmic pathology specimens (eg, eyelid biopsies, corneas, whole globes), and take macroscopic and microscopic photographs to document pathologies.\*\*
3. Prepare a basic histologic specimen (eg, hematoxylin-eosin stain) for review by the ophthalmic pathologist.
4. Perform microscopic examination of a specimen under supervision, and participate in writing the report, preferably previewing slides in advance of the pathologist to come up with a diagnosis and to suggest special stains and immunohistochemistry without the influence of the ophthalmic pathologist, followed by reviewing the report and special stain orders with the latter.

## **Very Advanced Level Goals: Subspecialist**

*These goals relate to, but build upon and are more advanced and distinct from, the second and third years of ophthalmic residency training.*

### A. Cognitive Skills

1. Describe advanced ocular anatomy, and identify histology of the minor structures of the eye and their uncommon variants (eg congenital grouped pigmentation).\*\*
2. Describe the more complex pathophysiology of the disease processes of the eye, and identify major histologic findings of each (eg, inflammatory pseudotumor, lymphoma, artifacts of tissue processing, virus particles).\*\*
3. Describe the histology of the less common but potentially vision or life-threatening ocular and adnexal diseases (eg, healed giant cell arteritis, mimics and masqueraders of inflammation and neoplasm, less common benign and malignant neoplasms).\*\*
4. Describe ancillary procedures for oncology (eg, bone marrow aspiration, cerebrospinal fluid cytology).

#### B. Technical/Surgical Skills

1. Manage consultation between the clinician and ophthalmic pathologist regarding indications for special stains (eg, Gram stain for bacteria, Congo red for amyloid; Gomori methenamine silver staining for fungi; Prussian blue for hemosiderosis; von Kossa for calcium; Oil Red O or Sudan Black for sebaceous carcinoma) or processing (eg, orientation of specimen, special handling).\*\*
2. Participate as an observer during the microscopic examination of active ophthalmology cases, including more advanced stains and techniques.\*\*
3. Participate in subspecialty clinical pathological meetings (eg, with corneal surgeons, infection specialists, tumor board).\*\*
4. Handle appropriately gross or cytologic specimens in the ophthalmic pathology laboratory (eg, vitreous biopsy, exenteration specimen).
5. Prepare more advanced histologic specimens for review by the ophthalmic pathologist (eg, special stains or fixation methods such as glutaraldehyde fixation for electron microscopy).
6. Perform microscopic examination of a paraffin-embedded specimen and a frozen-section specimen without direct supervision; provide a relevant differential diagnosis; draft a report—preferably previewing slides in advance of the pathologist—to come up with a diagnosis and to suggest special stains and immunohistochemistry, without the influence of the ophthalmic pathologist; review the report and special stain orders with the ophthalmic pathologist.
7. Participate with the ophthalmic pathologist in tumor board and similar multidisciplinary meetings, presentations on recent advances, and journal clubs involving pathology.
8. Research requirement: Publish at least one paper based on basic, translational, or clinical research involving ophthalmic pathology. The purpose of the requirement is to further the trainee's in-depth knowledge of pathophysiology and laboratory techniques relating to ophthalmic pathology.

\* \* \*

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# IX. Oculoplastic Surgery and Orbit

## Basic Level Goals: Year 1

### A. Cognitive Skills

#### **General**

1. Perform preoperative and postoperative assessment of patients with common oculoplastic disorders.\*\*

#### **Eyelid**

1. Describe basic anatomy and physiology (eg, orbicularis, meibomian glands, Zeis glands, orbital septum, levator muscle, Müller muscle, Whitnall ligament, Lockwood ligament, preaponeurotic fat, scalp, face).\*\*
2. Describe basic mechanisms and indications for treatment of eyelid trauma (lid margin sparing, lid margin involving, canaliculus involving).\*\*
3. Describe mechanisms and indications for treatment of ptosis.\*\*
4. Describe mechanisms and indications for treatment of upper and lower eyelid retraction.\*\*
5. Describe mechanisms and indications for treatment of entropion.\*\*
6. Describe mechanisms and indications for treatment of ectropion.\*\*
7. Identify floppy eyelid syndrome and its systemic associations.\*\*
8. Identify blepharospasm and hemifacial spasm.\*\*
9. Describe history and examination findings for benign and malignant lid lesions.\*\*

#### **Lacrimal**

1. Describe basic anatomy and physiology (eg, puncta, canaliculi, lacrimal sac, nasolacrimal duct, endonasal anatomy, lacrimal glands).\*\*
2. Identify dacryocystitis.\*\*
3. Describe mechanisms of tearing.\*\*
4. Describe mechanisms and indications for treatment of congenital and acquired nasolacrimal duct obstruction.\*\*
5. Recite the differential diagnosis of lacrimal gland mass (eg, inflammatory, neoplastic, congenital, infectious).\*\*

#### **Orbital**

1. Describe basic anatomy (eg, orbital bones, orbital foramina, paranasal sinuses, annulus of Zinn, arterial and venous vascular supply, nerves, extraocular muscles).\*\*
2. Identify normal orbital and relevant nasal and paranasal sinus anatomy on imaging studies (eg, computed tomography, magnetic resonance imaging).\*\*
3. Describe basic mechanisms and indications for treatment of orbital trauma (eg, medial wall and floor fractures, retrobulbar hemorrhage).\*\*
4. Describe the pathophysiology of thyroid eye disease.\*\*
5. Recite the differential diagnosis of common orbital tumors in children and adults.\*\*
6. Recite the differential diagnosis of proptosis in children and adults.\*\*
7. Describe typical features of orbital cellulitis.\*\*

### B. Technical/Surgical Skills

#### **Eyelid**

1. Describe indications for and perform the basic office examination techniques for the most common eyelid abnormalities (eg, margin reflex distance, palpebral fissure height,

levator function, lagophthalmos, lid crease, lid laxity assessment, brow height, dermatochalasis, eversion, double eversion).\*\*

2. Perform minor lid and conjunctival procedures (eg, repair of small eyelid laceration including marginal, removal of benign eyelid lesions, chalazion curettage or excision, conjunctival biopsy).\*\*
3. Treat complications of minor operating room procedures (eg, incision and drainage of chalazia, excision of small eyelid lesions).
4. Identify and treat trichiasis (eg, epilation, cryotherapy, surgical therapy).
5. Describe indications for and perform a temporary tarsorrhaphy.\*\*
6. Describe indications for and perform everting sutures (Quickert sutures).\*\*
7. Describe indications for and perform a lateral canthotomy/cantholysis.\*\*

### **Lacrimal**

1. Describe indications for and perform the basic office examination techniques for the most common lacrimal abnormalities (eg, Schirmer test, dye disappearance test, punctal position, punctal dilation, canalicular probing, lacrimal probing and irrigation).\*\*
2. Describe indications for and perform an incision and drainage of the lacrimal sac.\*\*
3. Perform punctal plug insertion or removal.

### **Orbital**

1. Describe indications for and perform the basic office examination techniques for the most common orbital abnormalities (eg, Hertel measurement, inspection, palpation, auscultation).\*\*
2. Identify indications for and perform the basic anophthalmic socket assessment (eg, types of implants, implant movement, socket health, socket surface, socket volume, fornices, prosthesis type and fit).

## **Standard Level Goals: Year 2**

### **A. Cognitive Skills**

#### **General**

1. Perform preoperative and postoperative assessment of patients with simple and more serious oculoplastic disorders (eg, multidisciplinary procedures).

#### **Eyelid**

1. Describe more advanced eyelid anatomy and physiology (eg, lymphatics).
2. Describe the mechanisms of and indications for eyelid reconstruction.\*\*
3. Describe the genetics (where known), clinical features, evaluation, and treatment of congenital eyelid deformities (eg, coloboma, distichiasis, epicanthus, telecanthus, blepharophimosis, ankyloblepharon, epiblepharon, euryblepharon, cryptophthalmia, Goldenhar syndrome, Treacher-Collins syndrome, Waardenburg syndrome).
4. Describe clinical features, evaluation, syndromic association and management of congenital ptosis (eg, simple, blepharophimosis-ptosis-epicanthus inversus syndrome [BPES], jaw wink, congenital fibrosis).\*\*
5. Describe the genetics (when applicable), clinical features, evaluation, and treatment of acquired myogenic ptosis (eg, oculopharyngeal muscular dystrophy, mitochondrial myopathies, myotonic dystrophy, myasthenia gravis).
6. Describe the clinical features, evaluation, and treatment of acquired neurogenic ptosis (eg, third nerve palsy, Horner syndrome).\*\*



7. Describe the mechanisms and indications for treatment of more advanced eyelid trauma (eg, chemical burns, thermal burns, canthal avulsions, eyelid avulsions).
8. Describe features, evaluation, and treatment of preseptal cellulitis versus orbital cellulitis.\*\*

### **Lacrimal**

1. Describe more advanced lacrimal anatomy and physiology (eg, lacrimal pump theories).
2. Describe the mechanisms and indications for treatment of more advanced lacrimal trauma (eg, nasolacrimal duct obstructions resulting from facial fractures).
3. Describe features, evaluation, and treatment of more complicated cases of nasolacrimal duct obstruction, canaliculitis, dacryocystitis, and acute and chronic dacryoadenitis.
4. Describe the genetics, clinical features, evaluation, and management of lacrimal dysgenesis.

### **Orbital**

1. Describe more advanced orbital anatomy and physiology (eg, vascular anatomy, neural anatomy, orbital septa).
2. Describe the clinical features, evaluation, and management of congenital orbital deformities (eg, anophthalmia, microphthalmia, hypotelorism, hypertelorism versus telecanthus).
3. Describe the genetics, clinical features, evaluation, and management of common craniosynostoses and other congenital malformations (eg, Crouzon syndrome, Apert syndrome).
4. Describe the mechanisms and indications for treatment of more advanced orbital trauma (eg, zygomaticomaxillary complex fractures, naso-orbital ethmoid fractures, Le Fort fractures).
5. Identify, evaluate, and treat thyroid ophthalmopathy (eg, epidemiology, symptoms and signs, associated systemic diseases, orbital imaging, differential diagnosis, surgical, medical, and radiation indications, side effects of treatment).\*\*
6. Identify, evaluate, and treat nonspecific orbital inflammation (eg, symptoms and signs, orbital imaging, differential diagnosis, biopsy indications, choice of treatments).\*\*

## **B. Technical/Surgical Skills**

### **Eyelids**

1. Describe indications for and perform more advanced examination techniques for less common eyelid abnormalities (eg, decreased blink, orbicularis weakness, contour abnormalities, marginal entropion).
2. Describe indications for and complications of, and perform more complicated minor lid procedures (eg, larger benign skin lesions, recurrent chalazia).
3. Describe indications for and complications of, and perform more complicated eyelid surgery (eg, upper blepharoplasty, lower lid tightening).
4. Describe indications for and complications of, and perform more advanced eyelid reconstruction (eg, wedge/pentagonal block resection).
5. Identify indications for and complications of, and treat blepharospasm and hemifacial spasm.
6. Identify histopathological features of common eyelid conditions.

### **Lacrimal**

1. Identify indications for and perform more advanced lacrimal assessment (eg, interpretation of dye testing, canalicular probing in trauma).

2. Describe indications for and complications of, and perform basic lacrimal procedures (eg, lacrimal drainage testing [irrigation, Jones Dye Tests 1 and 2], lacrimal probing, lacrimal intubation, incision and drainage of lacrimal sac abscess).
3. Identify indications for and interpret lacrimal imaging (eg, scintigraphy, cystography).
4. Identify histopathological features of common lacrimal conditions.

#### **Orbit**

1. Describe indications for and perform more advanced assessment of the orbit (eg, hypoglobus, facial asymmetry, enophthalmos, proptosis).\*\*
2. Describe indications for and complications of, and perform enucleation and evisceration.\*\*
3. Identify indications for and perform more advanced socket assessment (eg, extrusion of implants, anophthalmic socket complications).
4. Identify common orbital pathology (eg, orbital fractures, orbital tumors) on imaging studies (eg, magnetic resonance imaging, computed tomography, ultrasound).\*\*
5. Treat common presentations of orbital cellulitis.\*\*
6. Identify histopathological features of common orbital conditions.

### **Advanced Level Goals: Year 3**

#### **A. Cognitive skills**

##### **General**

1. Perform preoperative and postoperative assessment and coordination of care of patients with more advanced or complex oculoplastic-related disorders (eg, systemically ill patients, multidisciplinary procedures).

##### **Eyelid**

1. Describe the most advanced eyelid anatomy and physiology.
2. Describe the etiology, evaluation, and medical and surgical treatment of the following eyelid diseases:
  - a. Complex ectropion (eg, congenital, paralytic, involuntional, cicatricial, mechanical, allergic)
  - b. Complex entropion (eg, involuntional, spastic, cicatricial, congenital)
  - c. Complex myogenic ptosis (eg, myasthenia gravis, chronic progressive external ophthalmoplegia [CPEO], oculopharyngeal muscular dystrophy [OPMD], myotonic dystrophy)
  - d. Upper eyelid retraction
  - e. Lower eyelid retraction
  - f. Benign, pre-malignant, or malignant eyelid tumors (eg, papilloma, seborrheic keratosis, epidermal inclusion cyst, molluscum contagiosum, verruca vulgaris, keratoacanthoma, actinic keratosis, basal cell carcinoma, squamous cell carcinoma, sebaceous cell carcinoma, melanoma)
  - g. Single or recurrent inflammatory lesions (eg, recurrent chalazion or its mimics)
  - h. Facial nerve palsy with exposure keratopathy (eg, tarsorrhaphy, gold weight, lower lid tightening/elevation)

##### **Lacrimal**

1. Describe the most advanced lacrimal anatomy and physiology.

2. Describe the etiology, evaluation, and medical and surgical treatment of the following lacrimal diseases:\*\*
  - a. Punctal stenosis\*\*
  - b. Canalicular stenosis\*\*
  - c. Common canalicular stenosis\*\*

### **Orbital**

1. Describe the most advanced orbital anatomy and physiology.
2. Describe the etiology, evaluation, and medical and surgical treatment of the following orbital diseases: \*\*
  - a. Orbital trauma
    - i. All orbital fractures
    - ii. Retrobulbar hemorrhage\*\*
    - iii. Orbital foreign bodies
  - b. Orbital neoplasms
    - i. All benign
    - ii. All malignant
  - c. Orbital inflammation
    - i. Infectious
      1. Bacterial
      2. Fungal
      3. Mycoplasma
    - ii. Noninfectious
      1. Thyroid eye disease
      2. Sarcoidosis
      3. Wegener granulomatosis
      4. Nonspecific orbital inflammation
3. Describe epidemiology, clinical features, evaluation, and management of fetal alcohol syndrome.

### **B. Technical/Surgical Skills**

#### **Eyelid**

1. Describe indications for and perform more complicated and advanced “in office” examination techniques for less common but important eyelid abnormalities.
2. Perform more complicated lid procedures, including:
  - a. Frontalis sling
  - b. Lateral tarsal strip
  - c. Eyelid reconstruction

#### **Lacrimal**

1. Describe indications for and perform more complicated and advanced “in office” examination techniques for less common but important lacrimal abnormalities.
2. Perform more advanced lacrimal assessment (eg, intraoperative and postoperative testing, more complex trauma to lacrimal system).
3. Describe management of and treat lacrimal system abnormalities, including surgeries (eg, lacrimal probing, dacryocystectomy, dacryocystorhinostomy).

#### **Orbital**

1. Describe indications for and perform more complicated and advanced “in office” examination techniques for less common but important orbital abnormalities (eg, forced duction testing).
2. Describe typical and atypical features and describe the differential diagnosis, clinical features, and treatment of more complicated orbital diseases, including:
  - a. Complex orbital infections (eg, orbital cellulitis, mucormycosis, aspergillosis\*\*
  - b. Congenital tumors (eg, dermoid)
  - c. Fibro-osseous disorders and tumors (eg, fibrous dysplasia, osteoma, chondrosarcoma, osteosarcoma, Paget disease)
  - d. Vascular tumors (eg, capillary hemangioma, cavernous hemangioma, hemangiopericytoma, lymphangioma, Kaposi sarcoma)
  - e. Xanthomatous tumors (eg, xanthelasma, juvenile xanthogranuloma)
  - f. Lacrimal gland tumors (eg, benign mixed tumor, adenoid cystic carcinoma, malignant mixed tumor, lymphoma)
  - g. Neural tumors (eg, optic nerve glioma/meningioma, neurofibromatosis, neuroblastoma, schwannoma)
  - h. Sarcomas (eg, rhabdomyosarcoma, leiomyosarcoma, liposarcoma, osteosarcoma)
  - i. Lymphoid lesions (eg, lymphoid hyperplasia, lymphoma, leukemia)
  - j. Metastatic lesions (eg, from breast, prostate, lung, colon)
  - k. Thyroid eye disease
  - l. Nonspecific orbital inflammation
  - m. Trauma (eg, fractures, foreign body, retrobulbar hemorrhage, traumatic optic neuropathy)
3. Describe indications for and complications of basic orbital skills and procedures, including:
  - a. Anterior orbitotomy for tumor biopsy/excision
  - b. Orbital floor fracture repair
4. Describe indications for and complications of different orbital approaches and incisions (eg, Kronlein, Caldwell-Luc, transconjunctival, transnasal).\*\*
5. Describe indications for and interpret orbital ultrasound, computerized axial tomography (CT or CAT) scan, and magnetic resonance imaging (MRI) scan (eg, orbital trauma, orbital lesions, tumors). \*\*

### **Very Advanced Level Goals: Subspecialist**

#### A. Cognitive Skills

##### **General**

1. Perform preoperative and postoperative assessment and counseling of patients with cosmetic oculoplastic concerns.
2. Describe regional anatomy including graft donor sites frequently used (eg, cranial bone, ear, nose, temporal area, mouth and neck, abdomen, buttocks, legs, supraclavicular area, arm).
3. Describe the fundamentals of ocular and orbital anatomy, chemistry, physiology, microbiology, immunology, and wound healing.
4. Order and interpret imaging techniques.

5. Describe indications for more advanced imaging studies (eg, CT, MRI, magnetic resonance angiogram [MRA], positron emission tomography [PET]-CT, bone scan, arteriography, ultrasound).
6. Explain the principles of plain films, CT, MRI, and ultrasound imaging relating to the head and neck with particular emphasis on the orbit.
7. Describe indications for the type of scan/imaging to order given the clinical setting, and be able to read the film or scan.
8. Interpret ocular and periocular pathology and dermatopathology.

### **Eyelid**

1. Describe the clinical features, evaluation, and management of congenital syndromes, inflammation, trauma, ectropion, entropion, trichiasis, blepharoptosis, eyelid retraction, epiblepharon, dermatochalasis, blepharochalasis, eyelid tumors, blepharospasm, facial nerve palsy, eyebrow, midface and lower face function; and aesthetics, histology, and pathology of the facial skin.
2. Describe ocular surface pathology, including cicatricial processes affecting the bulbar and palpebral conjunctiva, management of corneal and conjunctival exposure, and relationship of the lids, midface, and brow to ocular exposure.
3. Describe the assessment of eyebrow position for brow ptosis and paralysis, and determine its relation to upper eyelid dermatochalasis.
4. Assess facial paralysis and evaluate the effects of upper eyelid lag and midface cicatricial, paralytic, and involuntional changes on lower eyelid position.
5. Describe complex eyelid trauma.
6. Describe complex eyelid reconstruction (eg, Hughes flap, free tarsal grafts, local flaps, skin grafts, Cutler-Beard procedure).

### **Lacrimal**

1. Describe the etiology, evaluation, and medical and surgical treatment of congenital tearing, acquired tearing, and trauma.

### **Orbital**

1. Describe the etiology, evaluation, and medical and surgical treatment of orbital problems of children (eg, congenital anomalies, cellulitis, benign and malignant tumors, orbital inflammations).
2. Describe the etiology, evaluation, and medical and surgical treatment of orbital disorders of adults, including orbital cellulitis, thyroid orbitopathy, idiopathic orbital inflammation, vasculitis, congenital tumors, vascular tumors, neural tumors, lacrimal gland tumors, fibro-osseous tumors, histiocytic diseases, lymphoid tumors, metastatic tumors, blunt and penetrating trauma, orbital and facial fractures, anophthalmic socket problems, and skull base disease.
3. Describe the types of and indications for various biomaterials and orbital implants.

### **Nose**

1. Describe basic anatomy and physiology.

### **Sinuses**

1. Describe basic anatomy and physiology.

### **Head and Neck as it Relates to the Orbit and Adnexa**

1. Describe basic anatomy and physiology.
2. Assess the face in terms of harmonious aesthetic units and evaluate the interrelationships of each.

## B. Technical/Surgical Skills

### **Eyelid**

1. Describe indications for and perform medical and surgical treatment of floppy eyelid syndrome.
2. Perform more complicated eyelid procedures, including:
  - a. Levator advancement
  - b. Retractor reinsertion
  - c. Lower eyelid elevation
  - d. Upper eyelid recession
  - e. Eyebrow elevation
3. Perform complex ptosis repairs (eg, reoperations for height or contour abnormalities).
4. Perform complex lower eyelid procedures (eg, retraction using a spacer, cicatricial entropion using a mucous membrane graft).
5. Perform midface surgery (eg, midface lift for cicatricial and paralytic ectropion).
6. Perform advanced brow elevation techniques (eg, endoscopic, pretrichial, coronal).
7. Perform advanced eyelid reconstruction (eg, Hughes flap, Cutler-Beard procedure, tissue transfer, flaps, grafts).
8. Perform cosmetic upper blepharoplasty.
9. Perform cosmetic lower blepharoplasty.
10. Excise benign and malignant tumors involving the periorbital and adjacent regions.

### **Lacrimal**

1. Describe management of and treat lacrimal system abnormalities, including:
  - a. Complex congenital disorders (eg, canalicular stenosis)
  - b. Complex trauma (ie, requiring lacrimal intubation)
2. Describe indications for and complications of, and perform intranasal endoscopic examination.
3. Describe management of complex acquired disorders and their treatment (eg, external and endoscopic dacryocystorhinostomy, conjunctivodacryocystorhinostomy with Jones tube).

### **Orbital**

1. Describe indications for and complications of, and perform basic orbital skills and procedures, including:
  - a. Socket reconstructions (eg, tissue transfers, grafts, flaps, synthetic implants)
  - b. Fracture repair of bones involving the periorbital region and orbit (eg, orbital floor, medial orbital wall, Le Fort, zygomaticomaxillary complex [ZMC], naso-orbito-ethmoid [NOE])
  - c. Orbitotomy for exploration, biopsy, and tumor removal using anterior, lateral, medial, and superior approaches; and orbital reconstruction
  - d. Enucleation, evisceration, exenteration, and secondary implants of the orbit
  - e. Complex or difficult socket-related problems and complications (eg, extrusion of implants, contracted socket, anophthalmic enophthalmos)
  - f. Optic nerve sheath fenestration
  - g. Orbital decompression for thyroid eye disease

### **Nasal**

1. Describe nasal endoscopy as related to the management of lacrimal and periorbital processes.

2. Describe turbinectomy and nasal surgery as related to the management of lacrimal and periorbital processes.

#### **Sinus**

1. Describe sinus surgery and endoscopy as related to periorbital and lacrimal processes.

#### **Head and Neck**

1. Describe facial flaps, including temporal, midface, lower face/neck for functional and aesthetic conditions related to the management of periorbital processes.
2. Describe rhytidectomy, including the periorbital and adjacent areas.
3. Repair upper face and brow conditions, including brow ptosis repair.
4. Use neuromodulators (eg, botulinum toxin), dermal fillers, other technologies (eg, laser) and chemical/pharmaceutical agents for the management of contour and skin quality abnormalities (ie, functional and aesthetic).

\* \* \*

***Note:** Inclusion of therapies and investigations in the ICO Residency Curriculum does not imply that listings are all inclusive or that methods are endorsed by the ICO. Appropriate levels of expertise and knowledge should be achieved based on the care provided. Practitioners should know of therapies and investigations not available at their hospital or clinic, so that they can advise patients who may be able to seek care elsewhere.*

## **X. Pediatric Ophthalmology and Strabismus**

### **Basic Level Goals: Year 1**

#### **A. Cognitive Skills**

1. Describe basic examination techniques for strabismus (eg, ductions and versions, cover and uncover testing, alternate cover testing, prism cover testing).\*\*
2. Describe basic visual development and visual assessment of the pediatric ophthalmology patient (eg, central, steady, maintained fixation), including any one matching card, resolution and recognition acuity, and crowding using standard vision testing (eg, tumbling E eye chart, Allen cards, Landolt "C" Broken Ring vision chart).\*\*
3. Describe the basic anatomy and physiology of strabismus:
  - a. Innervation of extraocular muscles\*\*
  - b. Primary, secondary, and tertiary actions\*\*
  - c. Laws governing the muscle actions\*\*
  - d. Comitant and incomitant deviations\*\*
  - e. Overaction and underaction\*\*
  - f. Restrictive and paretic saccades\*\*
  - g. Vergence\*\*
  - h. Pursuit movements\*\*
4. Describe basic sensory adaptations for binocular vision, including:
  - a. Normal and anomalous retinal correspondence\*\*
  - b. Suppression\*\*
  - c. Horopter\*\*
  - d. Panum area\*\*
  - e. Fusion\*\*
  - f. Stereopsis\*\*
5. Describe and recognize pseudostrabismus.\*\*
6. Describe the different etiologies of amblyopia, including:
  - a. Deprivation\*\*
  - b. Ametropic\*\*
  - c. Strabismic\*\*
  - d. Anisometropic\*\*
  - e. Organic\*\*
7. Describe various forms of esotropia, such as:
  - a. Congenital\*\*
  - b. Comitant and incomitant\*\*
  - c. Accommodative and nonaccommodative\*\*
  - d. Decompensated\*\*
  - e. Sensory\*\*
  - f. Neurogenic\*\*
  - g. Myogenic\*\*
  - h. Neuromuscular junction\*\*
  - i. Restrictive\*\*



- j. Nystagmus and esotropia\*\*
  - k. Spasm of the near\*\*
  - l. Monofixation syndrome\*\*
  - m. Consecutive\*\*
8. Describe various forms of exotropia, such as:
    - a. Congenital\*\*
    - b. Comitant and incomitant\*\*
    - c. Decompensated\*\*
    - d. Sensory\*\*
    - e. Neurogenic\*\*
    - f. Myogenic\*\*
    - g. Neuromuscular junction\*\*
    - h. Restrictive\*\*
    - i. Basic divergence excess\*\*
    - j. Exophoria\*\*
    - k. Convergence insufficiency\*\*
  9. Describe the nonsurgical treatment of strabismus and amblyopia, such as:
    - a. Patching\*\*
    - b. Atropine penalization\*\*
    - c. Fresnel and grind-in prism therapy\*\*
    - d. Convergence exercises\*\*
  10. Describe different forms of childhood nystagmus.\*\*
  11. Describe features, classification, and treatment indications for retinopathy of prematurity.\*\*
  12. Describe etiologies and types of pediatric cataract with consideration of:
    - a. Age of onset
    - b. When do you treat and types of treatment
    - c. Postoperative rehabilitation
  13. Describe and recognize ocular findings in child abuse (eg, retinal hemorrhages) and appropriately refer to Child Protective Services or other authorities.\*\*
  14. Describe basic evaluation of decreased vision in infants and children, such as:
    - a. Delayed maturation of vision\*\*
    - b. Leber congenital amaurosis\*\*
    - c. Other hereditary retinal disorders\*\*
    - d. Congenital glaucoma\*\*
    - e. Congenital rubella syndrome\*\*
    - f. Retinopathy of prematurity (ROP)\*\*
    - g. Various globe anomalies\*\*
  15. Describe the symptoms, associations, findings, and treatment of childhood glaucoma.\*\*
  16. Summarize ocular embryology development (ie, lens development, fetal vasculature, anterior segment development, closure of embryonic fissure).\*\*
  17. Describe common causes of conjunctivitis in infants and children in terms of symptoms, diagnosis, and treatment.\*\*
  18. Assess subluxated and dislocated lenses and know the systemic associations (eg, Marfan syndrome, homocystinuria, Weill-Marchesani syndrome).\*\*

19. Describe management of epiphora in children, including congenital nasolacrimal duct obstruction.\*\*
  20. Describe refractive errors and spectacle correction in childhood (recognizing that it is arguably the most common cause of preventable visual impairment in children worldwide).
  21. Describe accommodation and drugs used for cycloplegia.
  22. Describe indications and uses of contact lenses in childhood.
  23. Describe normal visual development milestones.
  24. Describe the basic principles of genetics.
- B. Technical/Surgical Skills
1. Perform an extraocular muscle examination based on knowledge of the anatomy and physiology of ocular motility.\*\*
  2. Assess ocular motility using duction and version testing.\*\*
  3. Apply Hering law and Sherrington law, and apply the most advanced knowledge of strabismus anatomy and physiology (eg, spiral of Tillaux, secondary and tertiary actions, spread of comitance) in evaluation of patients.\*\*
  4. Perform basic measurement of strabismus (eg, Hirschberg test, Krimsky method, cover testing, prism cover testing, simultaneous prism cover testing, alternate cover testing).
  5. Perform assessment of vision in the neonate, infant, and child, including:
    - a. Fixation preference test\*\*
    - b. Standard subjective visual acuity tests\*\*
    - c. Induced tropia test\*\*
  6. Perform cycloplegic retinoscopy in children using loose lenses, lens stick, or phoropter, depending on the age of the child and availability of the devices in the clinic.\*\*
  7. Measure the refractive condition of a patient's eyes using a retinoscope.\*\*
  8. Recognize and apply in a clinical setting the following skills in the ocular motility examination:
    - a. Stereoacuity testing\*\*
    - b. Accommodative convergence/accommodation ratio (eg, heterophoria method, gradient method)\*\*
    - c. Tests of binocularity and retinal correspondence\*\*
    - d. Cycloplegic refraction (ie, retinoscopy)\*\*
    - e. Anterior and posterior segment examination\*\*
    - f. Basic and advanced measurement of strabismus\*\*
    - g. Teller acuity cards\*\*
  9. Assist a primary surgeon in performing extraocular muscle surgery, including:
    - a. Recession\*\*
    - b. Resection\*\*
    - c. Muscle weakening (eg, tenotomy) and strengthening (eg, tuck) procedures\*\*
    - d. Transposition
    - e. Use of adjustable sutures
    - f. Intraoperative forced duction test (FDT)\*\*
  10. Probe tear ducts to diagnose and treat an obstruction.
  11. Medically and, if indicated, surgically manage chalazions.
  12. Treat molluscum contagiosum with curettage, if indicated.

## **Standard Level Goals: Year 2**

## A. Cognitive Skills

1. Describe basic and more advanced strabismus examination techniques (eg, combined vertical and horizontal prism cover testing, double Maddox rod testing).\*\*
2. Describe basic and more advanced visual development and visual assessment of the pediatric ophthalmology patient (eg, blink to light or threat, measures of fixation and following behavior, objective measures of visual acuity) using the optokinetic nystagmus (OKN) drum to assess fixation and electrophysiological techniques such as sweep visual evoked potential (VEP) evaluation.\*\*
3. Describe basics of binocular sensory testing (eg, Titmus stereo testing, Randot stereo testing, Worth 4-dot test, Bagolini lenses).\*\*
4. Describe etiologies, evaluation, and management of vertical strabismus, including:
  - a. Neurogenic\*\*
  - b. Myogenic\*\*
  - c. Neuromuscular junction\*\*
  - d. Oblique overaction or underaction\*\*
  - e. Dissociated vertical deviation\*\*
  - f. Restrictive\*\*
5. Describe various strabismus patterns (eg, A or V pattern) and associations with various types of comitant strabismus; the anatomic role of muscle pulleys; and the potential role of radiology in assessing complex strabismus.\*\*
6. Describe common hereditary or congenital ocular motility or lid syndromes (eg, Duane syndrome, Marcus Gunn jaw-winking syndrome, Brown syndrome).
7. Describe and recognize typical features of retinoblastoma (eg, differential diagnosis, evaluation, treatment indications, and types).\*\*
8. Describe basic evaluation and differential diagnosis of decreased vision in infants and children (eg, retinal and optic nerve etiologies, amblyopia).
9. Describe recognizable causes of blindness in infants (eg, albinism, optic nerve hypoplasia, achromatopsia, Leber congenital amaurosis, retinal dystrophy, congenital optic atrophy) and appropriate work up and associated diseases.\*\*
10. Describe cortical visual impairment and periventricular leukomalacia.\*\*
11. Interpret diplopia charts (eg, Hess charts, Lees chart, Harms screen).
12. Evaluate a child with congenital blindness, including VEP and interpretation of an electroretinogram (ERG).\*\*

## B. Technical/Surgical Skills

1. Perform more advanced strabismus testing, such as Parks-Bielschowsky 3-step test, Lancaster red-green test, Maddox rod testing, double Maddox rod testing, and measurement of dissociated vertical deviation (DVD).\*\*
2. Perform forced duction test (FDT) and force generation test (FGT) in the clinic.
3. Perform basic extraocular muscle surgery, and exercise surgical judgment for the indications and contraindications for strabismus surgery.\*\*
4. Perform preoperative extraocular muscle surgery assessment, intraoperative techniques, and describe intraoperative and postoperative complications of strabismus surgery.\*\*
5. Perform the following strabismus surgeries:
  - a. Recession\*\*
  - b. Resection\*\*

## **Advanced Level Goals: Year 3**

### **A. Cognitive Skills**

1. Describe more advanced anatomy (including pulleys) and physiology of strabismus (eg, torsion, tertiary actions, consecutive deviations).\*\*
2. Describe more advanced sensory adaptations (eg, anomalous head position).\*\*
3. Describe and recognize the different forms of childhood nystagmus (eg, infantile nystagmus syndrome [INS], fixation maldevelopment nystagmus syndrome [FMNS], spasmus nutans syndrome [SNS]), and appropriate work up for different time of onset and age groups.\*\*
4. Describe and recognize ROP (eg, stages, treatment indications).\*\*
5. List treatment options and indications of low birth weight children, and describe long-term ocular and systemic problems.\*\*
6. Describe and recognize less common hereditary or malformative ocular anomalies and syndromes (eg, Mobius syndrome, Goldenhar syndrome, Peter anomaly, including pedigree chart analysis).\*\*
7. Describe etiology, evaluation, and management of congenital infections (eg, TORCHES sequence: TOxoplasmosis, Rubella, Cytomegalovirus, HErpes simplex, Syphilis).\*\*
8. Describe and recognize the common causes of pediatric uveitis with natural history, indicated work up, and treatment.\*\*
9. Describe congenital optic nerve anomalies in children (eg, optic nerve coloboma, morning glory syndrome, optic nerve hypoplasia), and indicate necessary work up and associated diseases.\*\*
10. Describe American Association for Pediatric Ophthalmology and Strabismus (AAPOS) etiology position statements on learning difficulties and dyslexia, and know how to locate educational support resources for parents.
11. Identify referral centers for children with retinoblastoma, the work up for leukocoria, the evaluation of family members, and the principals of genetic counseling.
12. Describe typical features of childhood tumors (eg, hemangiomas, rhabdomyosarcoma) and their management.\*\*
13. Describe identifiable congenital ocular anomalies (eg, microphthalmia, persistent fetal vasculature), and describe appropriate work up for etiology, criteria for intervention, and genetic counseling for parents.
14. Describe indications for botulinum toxin use in strabismus.

### **B. Technical/Surgical Skills**

1. Perform a more advanced extraocular muscle examination based on knowledge of the anatomy and physiology of ocular motility.\*\*
2. Assess more advanced ocular motility problems (eg, bilateral or multiple cranial neuropathy, myasthenia gravis, thyroid eye disease).\*\*
3. Apply Hering law and Sherrington law in more advanced cases (eg, pseudoparesis of the contralateral antagonist, enhancement of ptosis in myasthenia gravis).\*\*
4. Perform more advanced measurements of strabismus (eg, use of synoptophore or amblyoscope, when available).\*\*
5. Perform assessment of vision in more difficult strabismus patients (eg, uncooperative child, mentally impaired, nonverbal, or preverbal).\*\*

6. Perform the following surgical techniques:
  - a. Muscle weakening (eg, tenotomy) and strengthening (eg, tuck) procedures of rectus muscles
  - b. Inferior oblique weakening procedures
  - c. Use of adjustable sutures
7. Manage the complications of strabismus surgery (eg, slipped muscle, anterior segment ischemia, overcorrection, undercorrection).

### **Very Advanced Level Goals: Subspecialist**

#### A. Cognitive Skills

1. Describe and perform the most advanced strabismus examination techniques (eg, complicated prism cover testing in multiple cranial neuropathies, patients with nystagmus, dissociated vertical deviation, double Maddox rod testing).\*\*
2. Perform and interpret the most advanced techniques for assessment of visual development in complicated or noncooperative pediatric ophthalmology patients (eg, less common objective measures of visual acuity, electrophysiologic testing).\*\*
3. Apply the most advanced knowledge of strabismus anatomy and physiology (eg, spiral of Tillaux, secondary and tertiary actions, spread of comitance) in evaluation of patients.\*\*
4. Describe clinical application of the most advanced sensory adaptations (eg, anomalous head position, anomalous retinal correspondence, methods of distance stereopsis).\*\*
5. Recognize and treat the most complicated etiologies of amblyopia (eg, refraction noncompliance, patching failures, pharmacologic penalization).\*\*
6. Recognize and treat the most complex etiologies of esotropia (eg, optical; postrefractive surgical esotropia [ET]; prism-induced ET decompensated esophoria; postsurgical and consecutive ET; sixth nerve palsy and paresis; thyroid eye disease, following closed head injury; Chiari malformation).\*\*
7. Recognize and treat the most complex etiologies of exotropia (eg, supranuclear, paralytic pontine exotropia, consecutive).\*\*
8. Recognize and treat the most complex strabismus patterns (eg, aberrant regeneration, postsurgical, thyroid ophthalmopathy, myasthenia gravis).\*\*
9. Recognize and treat the most complex etiologies of vertical strabismus (eg, skew deviation, postsurgical, restrictive).\*\*
10. Apply nonsurgical treatment (eg, patching, atropine penalization) of more complicated forms of amblyopia (eg, noncompliant, patching failures).\*\*
11. Recognize, evaluate, and treat the most complex forms of childhood nystagmus (eg, sensory, spasmus nutans, associated with neurologic or systemic diseases).\*\*
12. Recognize and treat (or refer for treatment) complex ROP (eg, stages, treatment indications, retinal detachment).\*\*
13. Recognize and treat (or refer for treatment) uncommon etiologies and types of pediatric cataract (eg, congenital, traumatic, metabolic, inherited).\*\*
14. Recognize and appropriately evaluate the more complex hereditary ocular syndromes (eg, bilateral Duane syndrome, Möbius syndrome).\*\*
15. Recognize and treat (or refer for treatment) patients with complicated retinoblastoma (eg, bilateral cases, monocular patient, treatment failure, pineal involvement).\*\*

16. Recognize and evaluate the less common congenital ocular anomalies (eg, unusual genetic syndromes).
17. Apply the most advanced principles of binocular vision and amblyopia (eg, physiology of binocular vision, diplopia, confusion and suppression, normal and abnormal retinal correspondence, classification and characteristics of amblyopia).\*\*
18. Recognize and treat complex pediatric retinal diseases (eg, inherited retinopathies).\*\*
19. Recognize and treat complex pediatric glaucoma.
20. Recognize and treat complex pediatric cataract and anterior segment abnormalities (including surgical implications, techniques, and complications).\*\*
21. Recognize and treat complex pediatric eyelid disorders (eg, congenital deformities, lid lacerations, lid tumors).
22. Recognize and treat (or refer for treatment) pediatric orbital diseases (eg, orbital tumors, orbital fractures, rhabdomyosarcoma, severe congenital orbital malformations).
23. Describe causes and testing of optic atrophy in children.\*\*
24. Describe methods of ocular assessment of children with other disabilities.\*\*
25. Describe ocular cysticercosis.\*\*
26. Describe screening strategies for childhood blindness at the community level and intervention.\*\*
27. Describe how to guide/refer parents of children with severe vision impairment.\*\*

#### B. Technical/Surgical Skills

1. Perform more complex extraocular muscle surgery (eg, vertical and horizontal muscle surgery, including superior oblique procedures, transpositions, reoperations).\*\*
2. Describe indications and contraindications for more complex strabismus surgery (eg, post scleral buckle and post cataract, thyroid related strabismus).\*\*
3. Describe and perform preoperative assessment, intraoperative techniques, and describe postoperative complications for more complicated strabismus surgery (eg, reoperations, stretched scar, slipped muscle, lost muscle).\*\*
4. Describe indications for and perform adjustable sutures in more complicated cases (eg, thyroid ophthalmopathy).\*\*
5. Describe and manage more complex complications of strabismus surgery (eg, globe perforation, corneal dellen, inclusion cysts, endophthalmitis, overcorrection, undercorrection).\*\*
6. Perform surgery of congenital cataract including posterior polar cataract (PPC), vitrectomy with/without intraocular lens implantation, persistent hyperplasia of the primary vitreous (PHPV)/persistent fetal vasculature (PFV), including biometric measurements to determine aphakia contact lens or intraocular lens.\*\*
7. Perform glaucoma surgery in pediatric and congenital glaucoma.
8. Perform corrective surgery in congenital eyelid anomalies like ptosis.
9. Perform nasolacrimal surgery in children.\*\*
10. Perform electromyography (EMG) guided or intraoperative injection of botulinum toxin for strabismus.
11. Diagnose ROP and refer for treatment.
12. Perform more complex strabismus procedures (eg, Faden sutures, posterior myopexy, Yokoyama muscle union, “Y” splitting).

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# **XI. Vitreoretinal Diseases**

## **Basic Level Goals: Year 1**

### **A. Cognitive Skills**

1. Describe basic principles of retinal anatomy and physiology (ie, basic retinal and choroidal anatomy, retinal and choroidal physiology), with emphasis on macular anatomy and physiology.\*\*
  2. Describe fundamentals of ancillary testing and demonstrate basic understanding of fluorescein angiography (angiographic phases), optical coherence tomography (OCT) (eg, macular anatomy, determine pathophysiology behind structural alterations).
  3. Describe pathological anatomy, physiopathology, and clinical pictures of the most common vascular diseases:\*\*
    - a. Diabetic retinopathy\*\*
    - b. Central vein occlusion\*\*
    - c. Branch vein occlusion\*\*
    - d. Arterial occlusion\*\*
    - e. Hypertensive retinopathy\*\*
  4. Describe features of different types of retinal detachment (ie, rhegmatogenous, tractional, exudative).\*\*
  5. Describe typical features of common macular diseases (eg, age-related macular degeneration [AMD], macular hole, macular pucker, central serous chorioretinopathy, chloroquine maculopathy, pseudophakic cystoid macular edema).\*\*
  6. Describe and recognize features of traumatic pathologies, including:
    - a. Commotio retinae
    - b. Traumatic choroidal rupture
    - c. Purtscher retinopathy
  7. Describe typical features of retinitis pigmentosa, main macular dystrophies (eg, Stargardt, Best, cone dystrophy), and other hereditary pathologies.
  8. Describe basic principles of laser photocoagulation (eg, laser response to change in power, duration, and spot size) and photodynamic therapy for retinal treatment.
  9. Describe basic principles, techniques, and safety of intravitreal injections.
  10. Diagnose, evaluate, and treat (or refer) postoperative/posttraumatic endophthalmitis.
- **B. Technical/Surgical Skills**
    1. Perform direct ophthalmoscopy.\*\*
    2. Perform indirect ophthalmoscopy.\*\*
    3. Perform slit-lamp biomicroscopy with precorneal lenses, 3-mirror contact lenses, or other wide-field contact lenses.\*\*
    4. Diagnose the presence of common retinal disorders such as exudative AMD, diabetic retinopathy, cystoid macular edema, central serous retinopathy, based on results of fundus examination, fundus photographs, OCT, and fluorescein angiography.

## **Standard Level Goals: Year 2**

### **A. Cognitive Skills**

1. Describe more advanced retinal anatomy and physiology.\*\*



2. Describe more advanced ancillary testing concepts of fluorescein and indocyanine green (ICG) angiography as applied to retinal vascular and other diseases (eg, indications, basic differential diagnosis based on angiographic patterns).\*\*
3. Describe the fundamentals of retinal electrophysiology and basic ophthalmic echography.
4. Diagnose, evaluate, treat (or refer) the following retinal vascular diseases:\*\*
  - a. Macular telangiectasia\*\*
  - b. Coats disease\*\*
  - c. Acquired retinal macroaneurysms\*\*
  - d. Ocular ischemic syndrome\*\*
  - e. Sickle cell retinopathy\*\*
  - f. Eales Disease\*\*
5. Describe the findings of major studies in vascular retinal diseases, including the following:\*\*
  - a. Diabetic retinopathy\*\*
    - i. Early Treatment Diabetic Retinopathy Study (ETDRS)
    - ii. Diabetes Control and Complications Trial (DCCT)
    - iii. United Kingdom Prospective Diabetes Study (UKPDS)
    - iv. Diabetic Retinopathy Clinical Research Network (DRCRnet) Trials
  - b. Central vein occlusion\*\*
    - i. Central Vein Occlusion Study (CVOS)
    - ii. Standard Care vs. Corticosteroid for Retinal Vein Occlusion (SCORE)
    - iii. Global Evaluation of implanTable dExamethasone in retinal Vein occlusion with macular edema (GENEVA) Study Group
    - iv. Central Retinal Vein Occlusion (CRUISE) Study
  - c. Branch vein occlusion\*\*
    - i. Branch Vein Occlusion Study (BVOS)
    - ii. Standard Care vs. Corticosteroid for Retinal Vein Occlusion (SCORE)
    - iii. GENEVA Study Group
    - iv. BRANCH Retinal Vein Occlusion (BRAVO) Trial
  - d. Retinopathy of prematurity\*\*
    - i. Cryotherapy for Retinopathy of Prematurity (CRYO-ROP)
    - ii. Early Treatment for Retinopathy of Prematurity (ETROP)
6. Describe the fundamentals of, evaluate, and treat (or refer) peripheral retinal diseases and vitreous pathologies (eg, vitreous hemorrhage, posterior vitreous detachment, retinal tears, giant retinal tears, lattice degeneration with atrophic holes).\*\*
7. Describe the techniques for retinal detachment repair, including indications, mechanics, instruments, basic techniques, and surgical adjuvants, including heavy liquids, expandable gases, and silicone oil for the following:
  - a. Pneumatic retinopexy\*\*
  - b. Scleral buckling\*\*
  - c. Vitrectomy\*\*
8. Describe and recognize typical features of less common macular diseases:
  - a. Myopic maculopathy\*\*
  - b. Serous retinal detachment secondary to optic disc pit\*\*
  - c. Ocular histoplasmosis syndrome\*\*
  - d. Phenothiazine/tamoxifen toxicity\*\*

9. Diagnose, evaluate, treat, and classify open and closed globe trauma (eg, Birmingham Eye Trauma Terminology System).\*\*
  10. Describe, evaluate, and treat (or refer) postoperative/posttraumatic choroidal detachments and sympathetic ophthalmia.\*\*
  11. Describe, recognize, and evaluate hereditary pathologies, such as juvenile retinoschisis and choroidal dystrophies (eg, choroideremia, gyrate atrophy).\*\*
  12. Describe the indications/complications for and perform basic laser treatment for diabetic retinopathy (eg, panretinal photocoagulation, macular grid).
- B. Technical/Surgical Skills
1. Perform indirect ophthalmoscopy with scleral indentation.
  2. Perform ophthalmoscopic examination with contact lenses, including panfunduscope lenses.
  3. Interpret fluorescein and indocyanine green (ICG) angiography and correlate findings with differential diagnosis.\*\*
  4. Diagnose the presence of pigment granules in the anterior vitreous (ie, Shafer sign) during a retinal detachment or retinal break.
  5. Describe the indications for and interpret retinal imaging technology (eg, OCT, retinal thickness analysis).\*\*
  6. Perform posterior segment photocoagulation.\*\*
  7. Perform diabetic focal/grid macular laser treatment.
  8. Perform peripheral scatter photocoagulation (panretinal).
  9. Perform laser retinopexy (demarcation) for isolated retinal breaks.
  10. Describe the indications for and interpret basic electrophysiological tests (eg, electroretinogram [ERG], electrooculogram [EOG], visual evoked potential [VEP], dark adaptation).
  11. Interpret basic echographic patterns (eg, rhegmatogenous retinal detachment, tractional retinal detachment, posterior vitreous detachment, choroidal detachment, intraocular foreign body).\*\*
  12. Perform fundus drawings of the retina, showing vitreoretinal relationships and findings.
  13. Perform (or assist during) cryotherapy of retinal holes and other pathology.
  14. Describe indications, techniques, and complications of pars plana vitrectomy and scleral buckling.
  15. Perform (or assist during) vitreous tap and intravitreal antibiotic injections for the treatment of endophthalmitis.
  16. Perform subtenon injections of triamcinolone acetonide for the treatment of macular edema.
  17. Perform intravitreal injection of anti-vascular endothelial growth factor (VEGF) drugs for the treatment of AMD.

### **Advanced Level Goals: Year 3**

- A. Cognitive Skills
1. Apply into clinical practice the most advanced knowledge of retinal anatomy and physiology (eg, surgical anatomy).\*\*

2. Apply into clinical practice the most advanced ancillary testing concepts of fluorescein/ICG angiography in complex retinal vascular disease and other vascular diseases.
  3. Describe and apply retinal electrophysiology.
  4. Evaluate, treat, or refer the most complex forms of retinal vascular diseases:
    - a. Combined arterial and venous obstructions
    - b. Advanced diabetic retinopathy
    - c. Advanced hypertensive retinopathy
    - d. Peripheral retinal vascular occlusive disease
  5. Describe the findings of major studies in age-related macular degeneration:\*\*
    - a. Treatment of Age-Related Macular Degeneration with Photodynamic Therapy Study (TAP)\*\*
    - b. Verteporfin in Photodynamic Therapy Study (VIP)\*\*
    - c. Minimally Classic/Occult Trial of the Anti-Vascular Endothelial Growth Factor (VEGF) Antibody Ranibizumab in the Treatment of Neovascular AMD (MARINA)\*\*
    - d. Anti-VEGF Antibody for the Treatment of Predominantly Classic Choroidal Neovascularisation in AMD (ANCHOR)\*\*
    - e. The Comparisons of Age-Related Macular Degeneration Treatments Trials (CATT)\*\*
  6. Evaluate and diagnose complex cases of retinal detachment (eg, acute retinal necrosis, proliferative vitreoretinopathy).
  7. Diagnose and classify retinopathy of prematurity.
  8. Diagnose and manage (or refer) complex trauma cases (eg, chorioretinitis sclopetaria, intraocular foreign body, shaken baby syndrome).
  9. Diagnose hereditary vitreoretinal degenerations (eg, Stickler syndrome, Wagner syndrome, Goldmann-Favre degeneration).
  10. Describe the treatment algorithm for each specific retinal condition, with special emphasis on pros and cons.\*\*
- B. Technical/Surgical Skills
1. Perform indirect ophthalmoscopy with scleral indentation in complex retinal cases (eg, multiple holes, documented with detailed retinal drawing).
  2. Perform ophthalmoscopic examination with panfunduscope or other lenses in complex retinal conditions (eg, giant retinal tears, proliferative vitreoretinopathy).
  3. Interpret and apply in clinical practice the results of fluorescein and ICG angiography and OCT in complex retinal or choroidal pathology.
  4. Perform posterior segment photocoagulation in more complicated retinal cases:\*\*
    - a. Diabetic focal/grid macular treatment (eg, monocular patient, repeat treatment)\*\*
    - b. Repeat peripheral scatter photocoagulation (panretinal)\*\*
    - c. Laser retinopexy (demarcation) of large or multiple breaks; cryotherapy\*\*
  5. Interpret and apply in clinical practice electrophysiology (eg, ERG, EOG, VEP, dark adaptation) in more complicated retinal pathology.
  6. Interpret and apply in clinical practice ocular imaging techniques (eg, B-scan echography) in more complex cases (eg, choroidal osteoma).

7. Perform detailed fundus drawings of the retina with vitreoretinal relationships in the most complex retinal cases (eg, recurrent retinal detachment, retinoschisis with and without retinal detachment).
8. Perform laser therapy or cryotherapy of retinal holes and other more complex retinal pathologies.\*\*
9. Participate during scleral buckling and pars plana vitrectomy surgeries.\*\*

### **Very Advanced Level Goals: Subspecialist**

*Subspecialty training level should require a greater understanding of the cognitive skills outlined in the previous levels. It should include an intensive hands-on training covering both laser and surgical treatment of the retina.*

*The trainee should be able to independently manage current medical treatment for vitreoretinal diseases and to discuss recent discoveries and possible future treatments for these disorders.\*\**

#### **A. Cognitive Skills**

1. Diagnose, evaluate, treat (or refer) the most complex forms of retinal vascular diseases and diagnose/manage risk factors (eg, blood dyscrasia) and systemic complications.
2. Diagnose, evaluate, and treat inherited, congenital, and acquired macular diseases.
3. Compare the current therapeutic retinal treatment strategies and be able to discuss the future improvements of the therapeutic armamentarium.
4. Evaluate and treat traumatic injuries to the retina, including complex cases such as intraocular foreign body with rhegmatogenous retinal detachment and traumatic macular holes, and be able to manage complications to the other ocular structures.
5. Diagnose, evaluate, and understand the genetic alterations and the possible applications of gene therapy for hereditary diseases.
6. Develop surgical proficiency in different surgical techniques for management of retinal detachment, including complex cases (eg, combined rhegmatogenous/tractional retinal detachments).

#### **B. Technical/Surgical Skills**

1. Perform posterior photocoagulation in complicated retinal cases:
  - a. Retinal breaks with vitreous hemorrhage
  - b. Cases with intraocular tamponade (ie, gas, silicone oil)
2. Interpret and apply electrophysiology in clinical practice.
3. Interpret and apply ocular imaging techniques in clinical practice (eg, B-scan echography) and in more complex cases (eg, choroidal osteoma).
4. Perform detailed fundus drawings of the retina with vitreoretinal relationships in the most complex retinal cases (eg, recurrent retinal detachment, retinoschisis with and without retinal detachment).
5. Perform laser therapy or cryotherapy of retinal holes and other more complex retinal pathology.
6. Perform scleral buckling in complex retinal detachment.
7. Perform advanced pars plana vitrectomy.

**Note:** *Inclusion of therapies and investigations in the ICO Residency Curriculum does not imply that listings are all inclusive or that methods are endorsed by the ICO. Appropriate levels of expertise and knowledge should be achieved based on the care provided. Practitioners should know of therapies and investigations not available at their hospital or clinic, so that they can advise patients who may be able to seek care elsewhere.*

## **XII. Uveitis and Ocular Inflammation**

### **Basic Level Goals: Year 1**

#### **A. Cognitive Skills**

1. Describe the definition and classification of intraocular inflammation.\*\*
2. Describe the basic principles of history taking:
  - a. Ocular history\*\*
    - i. Correlate with possible anatomical diagnosis (eg, photophobia and anterior uveitis; floaters and posterior uveitis)\*\*
    - ii. Describe the onset (sudden or insidious)\*\*
    - iii. Describe the duration (limited or persistent)\*\*
    - iv. Describe the course (acute, recurrent, chronic)\*\*
    - v. Investigation and treatment history\*\*
  - b. Systemic history\*\*
    - i. Known diseases, including immunosuppressed states, such as HIV, malignancy, diabetes mellitus\*\*
    - ii. Symptoms of recent onset for (eg, fever, chills, and rigors may suggest sepsis)\*\*
    - iii. Systems review, including all medications, past and current\*\*
3. List the clinical features of:
  - a. Anterior uveitis\*\*
  - b. Intermediate uveitis\*\*
  - c. Posterior or panuveitis\*\*
  - d. Episcleritis and scleritis (eg, red eye, blurred vision)\*\*
  - e. Anterior segment cell and flare\*\*
  - f. Keratic precipitates (nongranulomatous or granulomatous)\*\*
  - g. Posterior synechiae\*\*
  - h. Vitreous cell and flare\*\*
  - i. Vitreous opacities\*\*
  - j. Snowbank\*\*
  - k. Retinal and/or choroidal lesions\*\*
  - l. Retinal vasculitic\*\*
  - m. Retinal detachment (exudative, tractional, and rhegmatogenous)\*\*
  - n. Optic disc changes (eg, optic disc edema, optic neuritis).\*\*
4. Describe the typical demographic features, clinical features, and differential diagnosis of common, rapidly blinding causes for items 3a–3n above (based on local epidemiological data). For example:
  - a. Anterior uveitis
    - i. Infectious (eg, bacterial, viral, protozoal, parasitic)
    - ii. Inflammatory (eg, sarcoidosis, HLA B27-associated, juvenile idiopathic arthritis, Behçet disease, collagen vascular disease)
    - iii. Postsurgical uveitis
    - iv. Posttraumatic
    - v. Fuchs uveitis syndrome
    - vi. Posner-Schlossman syndrome

- b. Intermediate uveitis
    - i. Pars planitis
    - ii. Toxocariasis
    - iii. Sarcoidosis
    - iv. Multiple sclerosis
  - c. Posterior or panuveitis
    - i. Infectious (eg, toxoplasmosis, toxocariasis, tuberculosis, acquired and congenital ocular syphilis, acute retinal necrosis)
    - ii. Inflammatory (eg, sarcoidosis, Behçet disease, Vogt-Koyanagi-Harada disease, sympathetic ophthalmia)
    - iii. Postoperative uveitis
    - iv. Endophthalmitis (eg, postoperative, traumatic, endogenous, fungal, phacoanaphylactic)
  - d. Episcleritis and scleritis
    - i. Collagen vascular diseases (eg, rheumatoid arthritis, Wegener granulomatosis)
    - ii. Infection (eg, syphilis, tuberculosis, fungal, parasitic, bacterial)
  - 5. Describe indications for ancillary testing in the evaluation of uveitis (eg, fluorescein angiography [FA], indocyanine green [ICG] angiography, optical coherence tomography [OCT], B-scan ultrasonography).
  - 6. Describe indications for a tailored approach (based on clinical features) to laboratory investigations, including obtaining tissue and fluid samples for examination and systemic imaging studies (eg, x-ray of chest, sacroiliac joint, chest computerized axial tomography [CT or CAT] scan).
  - 7. Describe the indications and contraindications of topical steroids, nonsteroidal anti-inflammatory drugs (NSAIDs), and cycloplegics.
- B. Technical/Surgical Skills
1. Perform slit-lamp examination of the anterior segment to detect and evaluate clinical features of anterior uveitis, including:\*\*
    - a. Corneal pathology (active keratitis or scars, endotheliitis, band keratopathy)\*\*
    - b. Pattern of keratic precipitates (nongranulomatous, granulomatous)\*\*
    - c. Iris changes (rubeosis iridis, gross iris atrophy)\*\*
    - d. Anterior chamber evaluation of cells and flare, including grading according to standardization of uveitis nomenclature (SUN) working group grading system\*\*
    - e. Differentiate episcleritis from scleritis\*\*
    - f. Describe the activity (active or quiescent)\*\*
  2. Perform dilated examination of the posterior segment with slit-lamp biomicroscopy using noncontact and contact lenses, indirect ophthalmoscopy.\*\*
    - a. Vitreous evaluation for cells and flare, including grading of vitreous haze according to SUN working group grading system\*\*
    - b. Retina/choroid (retinal detachment, choroidal or retinal inflammation)\*\*
    - c. Retinal vasculature (vascular inflammation)\*\*
    - d. Optic disc (swelling, pallor)\*\*
  3. Describe the regional epidemiology of uveitis and relate this information to the diagnosis.
  4. List the following:

- a. Uveitis in immunosuppressed individuals with active and recovered acquired immune deficiency syndrome or pharmacologic immunosuppression (eg, cytomegalovirus retinitis, pneumocystis (carinii) jiroveci)
- b. Unusual infectious etiologies for uveitis (eg, Lyme disease, West-Nile fever)
- c. Masquerade syndromes such as vitreoretinal lymphoma
5. Differentiate infective from noninfective causes of uveitis.
6. Perform pars plana evaluation and sclera depression.
7. Interpret fluorescein angiography, B-scan ultrasonography, and correlate clinically.
8. Provide patient with all relevant information about proposed ancillary testing procedures for uveitis, including risks and complications.

## **Standard Level Goals: Year 2**

### A. Cognitive Skills

1. Describe the pathophysiology of intraocular inflammation.\*\*
2. Describe the principles of history taking of patients with uveitis according to SUN.
3. Describe the importance of being guided by clinical findings from the ocular examination and taking a more specific history in order to generate a list of differential diagnoses.\*\*
4. Describe more advanced principles of examination of patients with uveitis and differential diagnoses of the clinical signs:\*\*
  - a. Anterior segment (eg, iris nodules, pupillary membrane, peripheral anterior synechiae, iris bombe)\*\*
  - b. Posterior segment (eg, pars plana signs of inflammation [snowballs], retinal detachment, retinal vasculitis, optic swelling [differentiate optic neuritis from hyperemia], macula [macular edema])\*\*
5. Describe the regional epidemiology of uveitis and relate this information to the diagnosis.
6. Describe the typical demographic feature, clinical features, and differential diagnosis of:
  - a. Common uveitis in immunosuppressed individuals (eg, cytomegalovirus retinitis, endogenous endophthalmitis)
  - b. Masquerade syndromes such as vitreoretinal lymphoma
7. Differentiate serious infective from noninfective causes of uveitis. (eg, recognize an endogenous endophthalmitis and differentiate this from an immune-mediated uveitis, such as Behçet disease).
8. Describe angiographic features of retinitis, choroiditis, and vasculitis.
9. Describe the B-scan features of certain retinal, choroidal, and scleral diseases.
10. Describe the OCT features of macular edema.
11. Describe the common complications of common uveitis syndromes (eg, intraocular pressure elevation, cataract, band keratopathy, macular edema).
12. Describe indications and contraindications for corticosteroid treatment of uveitis (eg, topical, local, systemic), including risks and benefits of therapy.
13. Describe the management of common uveitic syndromes.

### B. Technical/Surgical Skills

1. Perform a more advanced examination of the anterior and posterior segment in addition to that described for Year 1.\*\*
  - a. Anterior segment (eg, iris nodules, pupillary membrane, peripheral anterior synechiae, iris bombe)\*\*



- b. Posterior segment (eg, pars plana signs of inflammation [snowballs], retinal detachment, retinal vasculitis, optic swelling [differentiate optic neuritis from hyperemia], macula [macular edema])\*\*
2. Recognize and evaluate the typical demographic features, clinical features, and differential diagnosis of common, rapidly blinding causes of uveitis (based on local epidemiological data), as described in the curriculum of Year 1.\*\*
3. Administer topical steroids, NSAIDs, and cycloplegics in the treatment of uveitis.\*\*
4. Interpret the results of ancillary tests (eg, fluorescein angiography, OCT, B-scan ultrasonography) for diagnosis.
5. Perform a major investigational work up (eg, laboratory testing, radiologic testing) according to epidemiologic data, history, and clinical examination.
6. Evaluate uveitis associated with immunosuppressed individuals (eg, active and recovered acquired immune deficiency syndrome, pharmacologic immunosuppression).
7. Interpret indocyanine green angiography findings and correlate clinically.
8. Perform posterior subtenon or transeptal injection of corticosteroids.
9. Administer oral corticosteroids in the treatment of uveitis.
10. Manage side effects of immunosuppressive therapy.
11. Perform an anterior chamber and vitreous tap for diagnostic purposes and administer intravitreal injection antibiotics in cases of bacterial endophthalmitis.

### **Advanced Level Goals: Year 3**

#### A. Cognitive Skills

1. Describe the more complex complications of common uveitis syndromes in addition to that mentioned in Year 2 (eg, retinal vascular occlusion, retinal neovascularization and vitreous hemorrhage, inflammatory choroidal neovascularization, hypotony).\*\*
2. Describe indications and contraindications for corticosteroid treatment of uveitis (eg, topical, local, systemic), including risks and benefits of therapy.\*\*
3. Describe the management of common uveitic syndromes.\*\*
4. Describe the techniques of anterior chamber and vitreous tap and of intravitreal injection of antibiotics in cases of bacterial endophthalmitis.\*\*
5. Describe more advanced examination principles for patients with more subtle signs of uveitis, such as:
  - a. Anterior segment (eg, conjunctival ulcer, iris transillumination defects, granuloma)
  - b. Posterior segment (eg, pars plana signs of inflammation [snowbanks and snowballs], retinal detachment [exudative, tractional, rhegmatogenous], retinal vasculitis [periphlebitis or arteritis, occlusive or nonocclusive], optic nerve [optic disc granuloma, optic neuritis, disc neovascularization], macula [macular edema, choroidal neovascularization])
6. Describe in greater detail the angiographic features of retinitis, choroiditis, and vasculitis.
7. Describe indications and contraindications for commonly used immunotherapy for uveitis in addition to corticosteroid therapy (eg, azathioprine, cyclosporine A), including risks and benefits of therapy.
8. Describe the clinical features and differential diagnoses for less common forms of uveitis (eg, Whipple disease, Crohn disease).

#### B. Technical/Surgical Skills

1. Perform a more advanced examination of the anterior and posterior segment, for example:\*\*
  - a. Anterior segment (eg, conjunctival ulcer, iris transillumination defects, granuloma)\*\*
  - b. Posterior segment (eg, pars plana signs of inflammation [snowbanks and snowballs], retinal detachment [exudative, tractional, rhegmatogenous], retinal vasculitis [periphlebitis or arteritis, occlusive or nonocclusive], optic nerve [optic disc granuloma, optic neuritis, disc neovascularization], macula [macular edema, choroidal neovascularization])\*\*
2. Differentiate active from inactive disease and arterial from venous side disease.\*\*
3. Recognize serious infective causes from noninfective causes of uveitis.\*\*
4. Recognize and evaluate the typical demographic features, clinical features, and differential diagnosis of uveitis common in the region via the process of history taking, clinical examination, and the use of investigative tools (such as FA, ICG, B-scan, OCT).\*\*
5. Recognize and evaluate the typical demographic features, clinical features, and differential diagnosis of uveitis in:\*\*
  - a. Immunosuppressed individuals (eg, cytomegalovirus retinitis, endogenous endophthalmitis)\*\*
  - b. Masquerade syndromes, such as vitreoretinal lymphoma\*\*
6. Evaluate the common complications of common uveitic syndromes (eg, glaucoma, cataract, band keratopathy, macular edema).\*\*
7. Administer periocular corticosteroid injections in addition to topical corticosteroids in the treatment of uveitis.\*\*
8. Perform an anterior chamber and vitreous tap for diagnostic purposes and to give intravitreal injection of antibiotics in cases of bacterial endophthalmitis.\*\*
9. Administer biologics.
10. Perform cataract removal.
11. Perform filtration surgery with antimetabolites.
12. Provide patient with relevant information about possible side effects of medications and proper monitoring of medications.

### **Very Advanced Level Goals: Subspecialist**

#### A. Cognitive Skills

1. Describe the clinical features and differential diagnoses for less common forms of uveitis (eg, Whipple disease, Crohn disease, bilateral acute depigmentation of the iris [BADI], diffuse unilateral subacute neuroretinitis [DUSN], onchocerciasis).\*\*
2. Describe the global epidemiology of uveitis and relate this information to the diagnosis.\*\*
3. Describe the management of the more complex complications of uveitis.\*\*
4. Describe indications for ultrasound biomicroscopy (eg, assess state of ciliary body in hypotony), laser flare photometry and electrophysiology in the evaluation of uveitis.\*\*
5. Describe indications, contraindications, and complications for immunosuppressive therapy in uveitis (eg, use of antimetabolites, cyclosporine, alkylating agents, biologic agents).\*\*

6. Describe indications, contraindications, and complications of retinal laser photocoagulation in uveitis.\*\*
7. Describe indications, contraindications, and complications of intravitreal injection of medications (eg, corticosteroids, antiviral therapy, antibiotics, anti-VEGF, anti-mitotic agents) and drug delivery systems (eg, for corticosteroid, ganciclovir).\*\*

B. Technical/Surgical Skills

1. Integrate history, clinical examination, and investigations in order to recognize and evaluate the less common uveitis entities.
2. Administer corticosteroids in the treatment of uveitis by various routes (eg, topical, periocular, systemic, and intravitreal injection).
3. Perform retinal laser photocoagulation for retinal vasculitis complicated by retinal capillary nonperfusion and associated retinal or optic disc neovascularization.
4. Regulate perioperative management of the uveitic eye for cataract removal.
5. Perform intravitreal injection of medications (eg, corticosteroids, antiviral therapy, antibiotics, anti-VEGF, antimitotic agents) and drug delivery systems (eg, for corticosteroid, ganciclovir).
6. Co-manage with other subspecialist as appropriate:
  - a. Biopsy of the vitreous, retina, or choroid to confirm/exclude vitreoretinal lymphoma or other tumors/infectious causes
  - b. Immunosuppressive therapy in uveitis including biologics (with or without the aid of an immunologist) and monitor for side effects
  - c. Intravitreal implants containing antiviral or corticosteroid medications
  - d. Ocular complications of uveitis (eg, macular edema, cataract, glaucoma, retinal detachment, band keratopathy, choroidal neovascularization, hypotony)

\* \* \*

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## **XIII. Ocular Oncology**

### **Basic Level Goals: Year 1**

*Year 1 equivalent: trainee ophthalmologist, any grade, not expecting to specialize in ocular oncology.*

#### **A. Cognitive Skills**

1. Describe the basic categorization of common conjunctival and intraocular tumors.\*\*
2. Describe the clinical features of the major types of ocular tumor.\*\*
3. Describe the symptoms and clinical manifestations indicating the presence of an ocular tumor (eg, leukocoria, sentinel vessels).\*\*
4. Describe the differential diagnosis of the major tumors.\*\*
5. Describe the examinations and tests by which ocular tumors are diagnosed.\*\*
6. Describe the systemic features of ocular tumors and how these features are detected.\*\*
7. Describe the basic management principles of ocular tumors.\*\*
8. Describe the epidemiology of the more common tumors (eg, melanoma).\*\*
9. Describe the methods, risks, and benefits of tumor biopsy.\*\*

#### **B. Technical/Surgical Skills**

1. Perform slit-lamp and ophthalmoscopic examination of patients with an ocular tumor.\*\*
2. Recognize an ocular tumor and refer to an ocular oncology subspecialist.\*\*
3. Contribute to the care of patients after treatment.\*\*

### **Standard Level Goals: Year 2**

*Year 2 equivalent: senior general ophthalmologist who may need to diagnose and refer patients with an ocular tumor and collaborate with an ocular oncologist in long-term aftercare.*

#### **A. Cognitive Skills**

1. Describe the classification of ocular tumors (ie, conjunctival and intraocular).\*\*
2. Describe the clinical features of ocular tumors and their secondary effects.\*\*
3. List the differential diagnosis for each of the ocular tumors.\*\*
4. Describe diagnostic techniques for ocular tumors (eg, examination under anesthesia for pediatric tumors, imaging, biopsy, laboratory tests, oncology referral).\*\*
5. Describe indications (eg, biopsy for lymphoma) and contraindications (eg, biopsy for retinoblastoma) for the various diagnostic techniques.\*\*
6. Describe the management options for ocular tumors with indications and contraindications for each form of management.\*\*
7. Describe the complications of ocular therapy and their management.\*\*
8. Describe basic histopathology of tumors, including immunohistochemistry.\*\*
9. Describe the prognosis of the different types of ocular tumor.\*\*
10. Describe the epidemiology of the more common tumors (eg, melanoma).\*\*
11. Describe the methods, risks, and benefits of tumor biopsy.\*\*

#### **B. Technical/Surgical Skills**

1. Perform naked-eye examination (eg, to recognize oculodermal melanosis).\*\*
2. Perform palpation of cervical lymph nodes.\*\*
3. Perform slit-lamp examination, gonioscopy, and indirect ophthalmoscopy to diagnose and localize ocular tumors.\*\*

4. Perform transillumination for intraocular tumors.\*\*
5. Perform B-scan ultrasonography to detect and measure intraocular tumors.\*\*
6. Perform sequential examination to assess the tumor over time (eg, atypical nevus).\*\*
7. Guide evaluation for systemic disease (eg, metastases, primary tumor, syndromes).\*\*
8. Perform excision of conjunctival tumors, avoiding seeding, or refer to an ocular oncology subspecialist for such surgery if possible.\*\*
9. Perform enucleation, obtaining long optic nerve if appropriate, or refer to a subspecialist for this surgery if necessary.\*\*
10. Collaborate with subspecialist in the preoperative care and referral of selected patients with an ocular tumor, avoiding potential pitfalls.\*\*
11. Provide short-term and long-term postoperative care to patients with an ocular tumor, collaborating with a subspecialist and other health care workers as appropriate.\*\*
12. Investigate and manage ocular complications as appropriate (eg, radiation retinopathy, macular edema, cataract, glaucoma).\*\*
13. Interpret the results of laboratory investigations and adjust management accordingly.\*\*
14. Discuss prognosis and various management options with patients and their families in a detailed, ethical, and compassionate manner.\*\*

### **Advanced Level Goals: Year 3**

#### **A. Cognitive Skills**

1. Describe the applied surgical anatomy, histology, and physiology of the eye and ocular adnexa with relevance to ocular oncology.
2. List the most common conjunctival and intraocular tumors.\*\*
3. Describe relevant pathological conditions, such as:\*\*
  - a. Nonneoplastic tumors (eg, hamartomas)\*\*
  - b. Neoplastic tumors\*\*
    - i. Benign (eg, nevus, hemangioma)
    - ii. Malignant (eg, melanoma, carcinoma, metastasis)
  - c. Traumatic lesions (eg, implantation cysts, hemorrhages)\*\*
  - d. Degenerative lesions (eg, disciforms, sclerochoroidal calcification)\*\*
  - e. Idiopathic disease (eg, juvenile xanthogranuloma, vasoproliferative tumor)\*\*
  - f. Paraneoplastic disease (eg, Bilateral diffuse uveal melanocytic proliferation)\*\*
  - g. Iatrogenic disease (eg, radiation-induced disease)\*\*
4. Describe relevant pathological techniques (eg, fixation, histology, immunohistochemistry).
5. Describe relevant genetic abnormalities and techniques:\*\*
  - a. Germinal and somatic mutations relevant to oncology (eg, retinoblastoma)\*\*
  - b. Important genetic techniques (eg, fluorescence in situ hybridization)\*\*
6. Describe the relevance of staging tumors (eg, TNM [Tumor, lymph Nodes, Metastasis] Classification of Malignant Tumors).
7. Describe the etiology of ocular tumors, such as:
  - a. Environmental factors (eg, conjunctival squamous cell carcinoma)
  - b. Genetic factors (eg, retinoblastoma)
  - c. Syndromes (eg, von Hippel-Lindau disease)
  - d. Malformations (eg, choroidal osteoma)

8. Describe the pathogenesis of ocular tumors (ie, how tumors cause harm):\*\*
    - a. Ocular effects (eg, neovascular glaucoma)\*\*
    - b. Systemic effects (eg, metastatic disease)\*\*
  9. Describe the epidemiology of the more common ocular tumors (eg, melanoma).\*\*
  10. Describe the principles of examination techniques:
    - a. Inspection
    - b. Transillumination
    - c. Color photography
    - d. Optical coherence tomography
    - e. Autofluorescence
    - f. Angiography (indocyanine green and fluorescein)
    - g. Ultrasonography
    - h. Magnetic resonance imaging
    - i. Computerized tomography
    - j. Positron emission tomography
    - k. Biopsy
      - i. Aspiration
      - ii. Incisional
      - iii. Excisional
      - iv. Impression cytology
    - l. Systemic investigation according to ocular tumor diagnosis
      - i. History
      - ii. Clinical examination
      - iii. Hematology and biochemistry
      - iv. Radiography
      - v. Ultrasonography
      - vi. Computerized tomography
      - vii. Magnetic resonance imaging
      - viii. Genetic testing
  11. Describe the clinical features of each tumor type:\*\*
    - a. Inspection/color photography\*\*
    - b. Investigational (ie, angiography, echography)\*\*
  12. List the differential diagnosis of each tumor, and describe the investigational approach for each condition.\*\*
  13. Describe how the following therapeutic modalities and their effects are relevant to ocular tumors:\*\*
    - a. Radiotherapy (eg, brachytherapy, external beam radiotherapy, proton beam)\*\*
    - b. Chemotherapy (eg, topical, intraocular, systemic)\*\*
    - c. Phototherapy (eg, photocoagulation, photodynamic therapy)\*\*
    - d. Cryotherapy (eg, liquid nitrogen, carbon dioxide)\*\*
    - e. Surgical resection (eg, local resection, enucleation)\*\*
  14. Describe how statistics can be applied to ocular oncology (eg, survival analysis).
  15. Describe the methods, risks, and benefits of tumor biopsy and how these can be avoided (eg, biopsy of retinoblastoma, incisional biopsy of conjunctival tumor).\*\*
- B. Technical/Surgical Skills

1. Perform or request appropriate examinations and investigations according to differential diagnosis.\*\*
2. Perform or refer for treatment for conjunctival or intraocular tumors, demonstrating awareness of the indications, contraindications, and complications of each treatment and having skill to administer short-term and long-term postoperative care:\*\*
  - a. Radiotherapy (eg, brachytherapy, external beam radiotherapy)\*\*
  - b. Phototherapy (eg, photodynamic therapy, transpupillary thermotherapy)\*\*
  - c. Surgical excision (eg, local resection, enucleation, exenteration)\*\*
  - d. Ocular pharmacological therapy by various routes (ie, topical, intravitreal, ophthalmic artery infusion, subtenon, systemic)\*\*
    - i. Chemotherapy and biological therapy
    - ii. Antiangiogenic agents
    - iii. Steroids
3. Interpret results of relevant laboratory tests and communicate results to patients, relatives, and health care workers; and adjust patient management accordingly.
4. Communicate prognosis with patients, relatives, and health care workers; and adjust patient management accordingly in collaboration, if necessary, with a subspecialist.\*\*
5. Use information technology and other aids to cope with lack of expert knowledge.\*\*
6. Assist patients with selecting the most appropriate management in collaboration, if necessary, with a subspecialist in ocular oncology.
7. Provide or organize appropriate psychological support, demonstrating empathy and an adequate awareness of the principles of this aspect of care (eg, giving bad news).\*\*
8. Collaborate with subspecialists and other health care professionals to provide patient-focused care.\*\*
9. Develop protocols and infrastructure for practice-based learning and improvement (eg, access to information, outcomes data).

### **Very Advanced Level Goals: Subspecialist**

*Subspecialist equivalent: senior ophthalmologist responsible for ocular oncology, either part-time or full-time, who receives ocular oncology patient referrals.*

#### **A. Cognitive Skills**

1. Describe the applied surgical anatomy, histology, and embryology of the eye and ocular adnexa with relevance to ocular oncology.
2. Describe the applied physiology of the eye and adnexa with relevance to ocular oncology.
3. Describe the applied pathology of the following:\*\*
  - a. Ocular tumors and pseudotumors\*\*
    - i. Congenital/developmental
      - 1.1. Conjunctiva
        - a. *Dermoid*
        - b. *Dermolipoma*
        - c. *Choristoma (simple and complex)*
      - 2.1. Uvea
        - a. *Lisch nodules*
        - b. *Stromal iris cyst*
        - c. *Lacrimal gland choristoma*

- 3.1. Retina
  - a. *Multiple congenital hypertrophy of the retinal pigment epithelium (CHRPE)*
  - b. *Astrocytic hamartoma*
  - c. *Hemangioblastoma*
  - d. *Cavernous angioma*
  - e. *Dominant exudative vitreoretinopathy*
  - f. *Norrie disease*
  - g. *Incontinentia pigmenti*
  - h. *Solitary CHRPE*
  - i. *Grouped pigmentation*
  - j. *Arteriovenous malformation (racemose angioma)*
  - k. *Posterior primary hyperplastic vitreous (PPHV)*
  - l. *Glioneuroma*
- ii. Inflammatory (infectious, noninfectious)
  - 1.1. Conjunctiva
    - a. *Granuloma (eg, syphilis, sarcoid)*
  - 2.1. Uvea
    - a. *Granuloma (eg, tuberculosis)*
    - b. *Uveal effusion*
    - c. *Posterior scleritis*
  - 3.1. Retina
    - a. *Granuloma (eg, toxocara)*
- iii. Neoplastic
  - 1.1. Benign
    - a. *Conjunctiva*
      - i. *Nevus*
      - ii. *Papilloma*
      - iii. *Oncocytoma*
      - iv. *Primary acquired melanosis*
      - v. *Reactive lymphoid hyperplasia*
      - vi. *Other*
    - b. *Uvea*
      - i. *Nevus/melanocytoma*
      - ii. *Hemangioma*
      - iii. *Osteoma*
      - iv. *Neurilemmoma*
      - v. *Neurofibroma*
      - vi. *Leiomyoma*
      - vii. *Mesectodermal leiomyoma*
      - viii. *Reactive lymphoid hyperplasia*
      - ix. *Bilateral diffuse uveal melanocytic proliferation*
      - x. *Other rare conditions*
    - c. *Retina*
      - i. *Retinoma/retinocytoma*
      - ii. *Adenoma*



- iii. *Fuchs adenoma*
- iv. *Benign medulloepithelioma*
- v. *Other*

2.1. Malignant

- a. *Conjunctiva*
  - i. *Melanoma*
  - ii. *Squamous cell carcinoma*
  - iii. *Sebaceous carcinoma*
  - iv. *Kaposi sarcoma*
  - v. *Lymphoma*
  - vi. *Extraocular tumor spread*
  - vii. *Metastasis*
  - viii. *Other*
- b. *Uvea*
  - i. *Melanoma*
  - ii. *Lymphoma*
  - iii. *Intraocular tumor spread from conjunctiva*
  - iv. *Systemic lymphoma*
  - v. *Systemic leukemia*
  - vi. *Metastasis*
  - vii. *Other*
- c. *Retina*
  - i. *Retinoblastoma*
  - ii. *Adenocarcinoma*
  - iii. *Malignant medulloepithelioma*
  - iv. *Lymphoma*
  - v. *Leukemia*
  - vi. *Metastasis*
  - vii. *Other*

iv. Traumatic

1.1. Conjunctiva

- a. *Implantation cyst*
- b. *Foreign body granuloma*
- c. *Pyogenic granuloma*

2.1. Uvea

- a. *Implantation cyst*
- b. *Choroidal hemorrhage*
- c. *Miotic cyst*

3.1. Retina

- a. *Retinopathy of prematurity*
- b. *Retinal detachment*
- c. *Massive reactive gliosis*

v. Degenerative

1.1. Conjunctiva

- a. *Lacrimal retention cyst*

2.1. Uvea

- a. *Disciform lesion*
      - b. *Sclerochoroidal calcification*
      - c. *Vortex vein ampulla*
    - 3.1. Retina
      - a. *Vasoproliferative tumor*
  - vi. Idiopathic
    - 1.1. Conjunctiva
      - a. *Lymphangiectatic cyst*
    - 2.1. Uvea
      - a. *Juvenile xanthogranuloma*
    - 3.1. Retina
      - a. *Coats disease*
      - b. *Combined hamartoma of retina and retinal pigment epithelium*
      - c. *Iris cyst*
      - d. *Ciliary epithelial cyst*
  - vii. Paraneoplastic disease
    - 1.1. Bilateral diffuse uveal melanocytic proliferation
    - 2.1. Carcinoma-associated retinopathy
    - 3.1. Melanoma-associated retinopathy
    - 4.1. Other
- 4. Describe the following pathological conditions:\*\*
  - a. Non-neoplastic tumors\*\*
    - i. Hamartoma
    - ii. Choristoma
    - iii. Granuloma
    - iv. Cyst
    - v. Hyperplasia
    - vi. Metaplasia
  - b. Neoplastic tumors\*\*
    - i. Benign
    - ii. Malignant
      - 1.1. Proliferation
      - 2.1. Invasion
      - 3.1. Seeding
      - 4.1. Metastasis
    - iii. Iatrogenic disease
      - 1.1. Radiation
      - 2.1. Pharmacology
      - 3.1. Surgery
      - 4.1. Phototherapy
- 5. Describe relevant pathological techniques, such as:
  - a. Fixatives\*\*
  - b. Frozen sections
  - c. Histology
  - d. Immunohistochemistry
  - e. Flow cytometry

- f. Other
- 6. Describe the following genetic abnormalities and techniques:
  - a. Germinal mutations relevant to oncology\*\*
  - b. Somatic mutations in tumors\*\*
  - c. Genetic techniques
    - i. Karyotyping
    - ii. Polymerase chain reaction
    - iii. Fluorescence in situ hybridization
    - iv. Multiplex ligation-dependent probe amplification
    - v. Gene expression profiling
    - vi. Comparative genomic hybridization
    - vii. Other
- 7. Describe the relevant staging and grading systems for ocular tumors (with ability to use appropriate methods as necessary, using appropriate references sources):
  - a. TNM Classification of Malignant Tumors cancer staging system
    - i. Uveal melanoma
    - ii. Retinoblastoma
    - iii. Conjunctival melanoma
    - iv. Conjunctival carcinoma
    - v. Ocular adnexal lymphoma
  - b. International retinoblastoma staging system
  - c. Reese-Ellsworth staging system for retinoblastoma
  - d. Other staging systems (eg, Collaborative Ocular Melanoma Study)
- 8. Describe the etiology of ocular tumors:
  - a. Environmental factors
  - b. Genetic factors
  - c. Syndromes
  - d. Malformations
  - e. Other
- 9. Describe the pathogenesis of ocular tumors:\*\*
  - a. Secondary effects of uveal melanoma\*\*
  - b. Secondary effects of retinoblastoma\*\*
  - c. Secondary effects of other tumors (eg, conjunctival tumors)\*\*
- 10. Describe the epidemiology of ocular tumors:
  - a. Principles of epidemiology
- 11. Describe the principles of examination techniques:\*\*
  - a. Inspection\*\*
    - i. Slit-lamp examination
    - ii. Gonioscopy and 3-mirror examination
    - iii. Ophthalmoscopy
  - b. Transillumination\*\*
    - i. Transpupillary
    - ii. Transscleral
  - c. Color photography\*\*
    - i. Standard ocular photography
    - ii. Specialized cameras (eg, RetCam, Optos)

- iii. Autofluorescence photography
  - d. Angiography\*\*
    - i. Fluorescein angiography
    - ii. Indocyanine green angiography
  - e. Ultrasonography\*\*
    - i. A-scan ultrasonography
    - ii. B-scan ultrasonography (including high frequency)
    - iii. Doppler ultrasonography
  - f. Magnetic resonance imaging\*\*
  - g. Computerized tomography\*\*
  - h. Positron emission tomography\*\*
  - i. Biopsy\*\*
    - i. Aspiration
    - ii. Incisional
    - iii. Excisional
    - iv. Impression cytology
  - j. Systemic investigation according to ocular tumor diagnosis\*\*
    - i. History
    - ii. Clinical examination
    - iii. Hematology and biochemistry
    - iv. Radiography
    - v. Ultrasonography
    - vi. Computerized tomography
    - vii. Magnetic resonance imaging
    - viii. Genetic testing
- 12. Describe the clinical features of each tumor type.\*\*
  - a. Inspection/color photography\*\*
  - b. Investigational (ie, angiography, echography)\*\*
- 13. List the differential diagnosis of each tumor and describe the investigational approach for each condition.\*\*
- 14. Describe how the following therapeutic modalities and their effects are relevant to ocular tumors:\*\*
  - a. Radiotherapy\*\*
    - i. Radiation
      - 1.1. Radioactive sources (eg, iodine, ruthenium)
      - 2.1. Types of radiation (eg, gamma, beta, proton)
    - ii. Biological effects
  - b. Chemotherapy\*\*
  - c. Phototherapy\*\*
  - d. Cryotherapy\*\*
  - e. Surgical resection\*\*
- 15. Describe how the following statistics can be applied to ocular oncology:
  - a. Statistical correlations
    - i. Univariate
    - ii. Multivariate
  - b. Survival statistics

- i. Kaplan-Meier analysis
  - ii. Cox analysis
  - iii. Neural networks
  - iv. Accelerated failure time
  - c. Bias
  - d. Power calculations
  - e. Other relevant statistical methods
- B. Technical/Surgical Skills
1. Perform or request the following examinations, interpreting and documenting any findings, demonstrating awareness of the indications, contraindications, and limitations of each investigation:\*\*
    - a. Slit-lamp examination of conjunctiva and assessment of conjunctival fornices\*\*
    - b. Slit-lamp examination of anterior chamber and gonioscopy\*\*
    - c. Binocular indirect ophthalmoscopy with indentation\*\*
    - d. Transpupillary transillumination\*\*
    - e. A-scan and B-scan ultrasonography of anterior and posterior eye\*\*
    - f. Color and autofluorescence photography\*\*
    - g. Fluorescein angiography\*\*
    - h. Indocyanine green angiography\*\*
    - i. Magnetic resonance imaging\*\*
    - j. Incisional and excisional conjunctival tumor biopsy\*\*
    - k. Aspiration, incisional, or excisional biopsy of intraocular tumor\*\*
    - l. Other relevant examinations and investigations\*\*
  2. Perform or refer for the following treatments for conjunctival tumors, demonstrating awareness of the indications, contraindications, and complications of each treatment:\*\*
    - a. Surgical excision\*\*
    - b. Cryotherapy\*\*
    - c. Brachytherapy\*\*
    - d. External beam radiotherapy, including proton beam radiotherapy\*\*
    - e. Topical therapy (eg, mitomycin C, 5-fluorouracil, interferon)\*\*
  3. Perform or refer for the following treatments for intraocular tumors, demonstrating awareness of the indications, contraindications, and complications of each treatment:\*\*
    - a. Radiotherapy\*\*
      - i. Brachytherapy (eg, iodine, ruthenium, strontium, palladium, iridium)
      - ii. External beam radiotherapy
      - iii. Stereotactic radiotherapy
      - iv. Charged particle radiotherapy (eg, proton beam)
    - b. Phototherapy\*\*
      - i. Photocoagulation
      - ii. Transpupillary thermotherapy
      - iii. Photodynamic therapy
    - c. Surgical excision\*\*
      - i. Iridectomy
      - ii. Iridocyclectomy
      - iii. Transscleral choroidectomy
      - iv. Transretinal choroidectomy

- v. Enucleation
- vi. Exenteration
- d. Ocular pharmacological therapy by various routes (ie, topical, intravitreal, ophthalmic artery infusion, subtenon, systemic)\*\*
  - i. Chemotherapy and biological therapy
  - ii. Antiangiogenic agents
  - iii. Steroids
- 4. Request the following investigations, interpreting and communicating the results to patients, relatives, and health care workers, adjusting patient management accordingly.\*\*
  - a. Histopathological assessment of tumor samples\*\*
  - b. Genetic assessment of tumor samples\*\*
  - c. Laboratory investigation of vitreous samples\*\*
  - d. Other\*\*
- 5. Estimate the prognosis and communicate the following implications with patients, relatives, and health care workers, adjusting patient management accordingly.\*\*
  - a. Visual acuity\*\*
  - b. Local tumor control\*\*
  - c. Possible side effects and complications of therapy\*\*
  - d. Ocular conservation\*\*
  - e. Systemic manifestations of disease, including metastasis\*\*
  - f. Systemic complications and side effects of therapy\*\*
  - g. Survival probability and chances of disease-related mortality\*\*
  - h. Heritability\*\*
  - i. Use information technology and other aids to enhance prognostication\*\*
- 6. Communicate the following to patients, relatives, and health care workers:\*\*
  - a. Diagnosis, extent and severity of disease, including diagnostic uncertainty\*\*
  - b. Natural history without treatment\*\*
  - c. Therapeutic options with advantages and limitations of each therapy, including methods available elsewhere\*\*
  - d. Logistical implications of selected treatment\*\*
  - e. Use information technology and other aids to support this process\*\*
    - i. Websites
    - ii. Printed leaflets
    - iii. Audio recordings
  - f. Other relevant materials\*\*
- 7. Assist patients with selecting the most appropriate management, taking into account:\*\*
  - a. Patient age, gender, culture, wishes, needs, and fears\*\*
  - b. Costs and logistics\*\*
  - c. Availability of health care resources, locally and elsewhere\*\*
- 8. Provide or organize appropriate psychological support, demonstrating empathy and an adequate awareness of the principles of this aspect of care, such as:\*\*
  - a. Giving bad news\*\*
  - b. Communicating with relatives\*\*
  - c. Enabling long-term communication and support\*\*
- 9. Develop and maintain a multidisciplinary team of health care professionals to provide patient-focused care by activities, such as:

- a. Recruiting staff and coworkers
  - b. Developing service operating procedures.
  - c. Maintaining efficient and varied methods of communication and education
    - i. Between multidisciplinary team members (MDT)
    - ii. Between MDT and other practitioners (eg, pathologists)
    - iii. Between MDT and patient
10. Develop protocols and infrastructure for practice-based learning and improvement, including:
- a. Proformas and databases for storing data
  - b. Protocols for extracting and analyzing data
  - c. Application of study designs and statistical methods
  - d. Adherence to clinical governance
    - i. Informed consent
    - ii. Confidentiality
    - iii. Ethical committee approval

\* \* \*

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## **XIV. Low Vision Rehabilitation**

*As vision rehabilitation is concerned with visual functioning, it cuts across all other ophthalmic subspecialties that are based on anatomy or structure. Vision rehabilitation deals with the consequences of a wide range of eye diseases with the focus being on how the person with low vision functions. Interventions might include medical and/or surgical measures but also involve patient education and training. The ultimate determination of vision rehabilitation's success is functional improvement and quality of life for a person with low vision.*

### **Basic Level Goals: Year 1**

#### **A. Cognitive Skills**

1. Describe the definition, categories (types), and degrees of low vision.\*\*
2. Describe the most common causes of low vision (global and regional epidemiology and its impact on different age groups).
3. Describe the role of the ophthalmologist in recognizing the need for referring patients to a low vision rehabilitation service.\*\*
4. Describe the special aspects of vision-assessment techniques for children and adults with low vision (eg, Early Treatment of Diabetic Retinopathy Study charts, LogMAR visual acuity chart, SOSH low vision chart set, LEA test eye charts).\*\*
5. Describe significant co-morbidities that impact low vision rehabilitation.
6. Describe various low vision aids.\*\*
7. Describe the basic optics of low-vision devices.
8. Demonstrate sensitivity to psychological and emotional aspects of visual impairment.\*\*
9. Describe challenges commonly encountered by individuals with visual impairments.\*\*
10. Describe how low vision impacts safety, including risk of falls, errors in medication, and driving accidents.\*\*
11. Describe the importance of different visual functions, including:
  - a. Visual acuity (far and near distance)
  - b. Contrast sensitivity
  - c. Central and peripheral visual field
  - d. Light and dark adaptation
  - e. Depth perception
  - f. Color vision

#### **B. Technical Skills**

1. Perform an evaluation of visual function in patients with low vision.\*\*
2. Describe how to use high-add reading glasses with and without a base-in (BI) prism.\*\*
3. Prescribe simple but appropriate rehabilitative therapies and optical devices to help the patient meet their goals (eg, magnification, illumination).\*\*
4. Encourage patients with low vision to actively participate in visual rehabilitation.\*\*
5. Describe the functional losses of vision that may occur with various ocular diseases.
6. Describe the functional losses that might result from certain treatments.

### **Standard Level Goals: Year 2**

#### **A. Cognitive Skills**

1. Recognize significant comorbidities that impact low vision rehabilitation.



2. Recognize and describe clinical applications, indications, and limitations of the various low vision aids (eg, electronic and optical magnification, large print, Braille, computers with artificial speech, text to speech).\*\*
  3. Describe the more advanced optics of low vision devices.
  4. Describe visual acuity and visual field evaluation methods for different levels of disability.\*\*
  5. Describe the evaluation of and rationale for licensing automobile drivers who are visually impaired, and explain the local licensing regulations.
- B. Technical Skills
1. Prescribe more complex rehabilitative therapies and optical devices to help the patient meet their goals.
  2. Perform evaluation of vision assessment in licensing drivers who are visually impaired.
  3. Demonstrate low vision devices and educate low vision patients on the uses and limitations of these devices.\*\*

### **Advanced Level Goals: Year 3**

- A. Cognitive Skills
1. Describe significant comorbidities that impact low vision rehabilitation.\*\*
  2. Describe the role of visual processing and perception deficits (eg, cerebral visual impairment, acquired brain injury, stroke).
  3. Describe indications for the most complex low vision aids.
  4. Apply more complex principles of optics of low vision devices.
  5. Describe vision related quality of life measurements.
  6. Describe social or public consequences and implications of low vision.\*\*
  7. Describe the role of the electrophysiological examinations as diagnostic and prognostic tools for low vision patients.
  8. Describe the implications of low vision in the education of children.\*\*
- B. Technical Skills
1. Evaluate visual acuity and visual field for determination of disability for legal and insurance purposes.
  2. Prescribe the most complex rehabilitative therapies and optical devices to help the patient meet their goals.
  3. Apply and prescribe visual field enhancing techniques, including scanning training for hemianopic field loss.
  4. Perform short cognitive assessment of elderly patients with visual impairments for drivers' license approval.

### **Very Advanced Level Goals: Subspecialist**

- A. Cognitive Skills
1. Describe the process of complex rehabilitation, including:\*\*
    - a. Optical rehabilitation\*\*
    - b. Nonoptical aids\*\*
    - c. Eccentric fixation training and scotoma avoidance\*\*
    - d. Orientation and mobility\*\*

- e. Activities of daily living\*\*
  - f. Vision substitution (eg, touch, hearing)\*\*
  - g. Psychological care\*\*
2. Describe the role of all of the partners and team members in the patient's care and in low vision rehabilitation (eg, ophthalmologists, social workers, psychologists, rehabilitation trainers).\*\*
  3. Describe the main aims and projects of VISION 2020.
  4. Describe the effects of low vision on the general health and on the psychological well-being of the patient.\*\*
  5. Describe the concept of artificial vision and implantation of microchips for the treatment of patients with the most profound visual impairments.
  6. Describe a low-vision-friendly physical environment that includes easy accessibility (eg, ergonomics, special visual signs in buildings/streets, talking elevators/traffic signs).\*\*
- B. Technical Skills
1. Identify basic low vision and other surgical and medical interventions necessary to ensure the best possible visual outcome.
  2. Oversee and provide referrals to support the patient's psychological adjustment to life after acute vision loss.\*\*
  3. Educate patients on use of low vision equipment.\*\*
  4. Be well informed and instruct patients with low vision of comprehensive rehabilitation resources in the region and in the country, including offering provider contact details.\*\*
  5. Interact with other professionals (eg, psychologists, occupational therapists, vocational counselors, social workers) to improve the daily life of patients with low vision.\*\*

\* \* \*

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## **XV. Ethics and Professionalism in Ophthalmology**

*Some of the goals listed below are specific to the requirements of the United States or other nations. They are included here as a guideline only.*

### **Basic Level Goals: Year 1**

1. Provide the definition and basic concepts behind the following terms used in medical ethics:
  - a. Morality versus ethics (intent-based standards versus conduct-based standards)
  - b. Autonomy and surrogacy
  - c. Beneficence
  - d. Nonmaleficence
  - e. Truth telling
  - f. Distributive justice
  - g. Fiduciary responsibility to patients
  - h. Compassion
2. Describe the ethical principles listed in the following key medical documents:
  - a. Hippocratic Oath<sup>1</sup>
  - b. Declaration of Geneva<sup>2</sup>
  - c. Ethical Code, International Council of Ophthalmology<sup>3</sup>
  - d. Code of Ethics, American Academy of Ophthalmology<sup>4</sup>
3. Describe the basics of ophthalmic practice management:
  - a. Partnership arrangements
  - b. Income distribution methods
  - c. Contractual negotiations
  - d. Hiring and supervising of employees
  - e. Basic accounting
    - i. Profit/loss statements
    - ii. Billing
    - iii. Collections
  - f. Financial management
4. Describe the basics of the health care system and reimbursement for services as appropriate to the local, regional, and national market of the trainee (eg, medical documentation, third party payers, managed care, Medicare [USA], Medicaid [USA], private insurance, nationalized health care systems [United Kingdom, Canada, and others]).

### **Standard Level Goals: Year 2**

1. Describe basic medical ethics in the ophthalmic practice, including:
  - a. Confidentiality of health information
  - b. Professional competence and maintenance of competence
  - c. Informed consent
  - d. Responsibility to report the unethical conduct of others

- e. Adequate patient assessment and avoidance of under/over treatment and under/over testing
2. Identify elements of effective physician-patient communication, including:
  - a. Relevant cultural and linguistic differences that potentially influence ethical delivery of services
3. Describe advanced aspects of practice management (eg, business models, documentation requirements and coding, privacy requirements, accommodating patients or employees with disabilities).
4. Describe advanced aspects of health care reimbursement (eg, physicians' role in managed care organizations, administrative role, third-party reimbursement, capitated programs).
5. Describe the framework of patient-care quality as it relates to patient safety, patient advocacy, effectiveness, efficiency, timeliness, and equity.
6. Describe how ophthalmologists are responsible for ensuring that all those in the service area of the practice have access to affordable eye care, and define how ophthalmologists are uniquely trained and certified to do so.
7. Identify the various missions of ophthalmology organizations with respect to service to members, patients, clinical education, quality of care. Define and mitigate the consequences of conflicting missions.
8. Identify how participation of ophthalmologists in ophthalmology organizations serves the profession and society.
9. Identify the responsibilities of ophthalmologists and ophthalmology societies to ensure that everyone has the right to sight.

### **Advanced Level Goals: Year 3**

1. Recognize and use advanced medical ethics in the ophthalmic practice:
  - a. Applicable informed consent documents (eg, clinical research, off-label use disclosures)
  - b. Management (offering and rendering) of second opinions
  - c. Individual and institutional responsibilities regarding impaired physicians
  - d. Responsibility for postoperative care, including appropriate transfer of care to other physicians
  - e. Appropriate delegation to limited license auxiliaries
  - f. Fairness of fees
  - g. Management of conflicts of interest (clinical and nonclinical)
    - i. Disclosures
    - ii. Gifts to physicians
  - h. Appropriate advertising (and applicable laws)
    - i. Appropriate conduct as a medical-expert witness in litigation
2. Describe the ethical principles listed in the following key medical documents regarding research involving human subjects:
  - a. Nuremburg Code<sup>5</sup>
  - b. Declaration of Helsinki<sup>6</sup>
  - c. Belmont Report<sup>7</sup>
3. Identify applicable insurance coverage responsibilities in a practice situation.

4. Utilize more advanced aspects of health care reimbursement in a clinical practice (eg, denials of claims, hospital contracting, electronic billing).
5. Work within integrated eye care delivery systems (both within eye care specialties and within general medicine and surgery).
6. Participate in all of the foregoing aspects of practice management to the best ability within a medical education setting.
7. Utilize all of the foregoing ethical principles and knowledge in direct patient care.
8. Describe the responsibility of ophthalmologists to share their knowledge of clinical arts and sciences for the benefit of patients, the profession, and society.

## Medical Ethics Documents

1. Hippocratic Oath  
[http://www.nlm.nih.gov/hmd/greek/greek\\_oath.html](http://www.nlm.nih.gov/hmd/greek/greek_oath.html)
2. Declaration of Geneva, World Medical Association  
<http://www.wma.net/en/30publications/10policies/g1/>
3. Ethical Code, International Council of Ophthalmology  
[www.icoph.org/pdf/icoethicalcode.pdf](http://www.icoph.org/pdf/icoethicalcode.pdf)
4. Code of Ethics, American Academy of Ophthalmology  
[http://www.aao.org/about/ethics/code\\_ethics.cfm](http://www.aao.org/about/ethics/code_ethics.cfm)
5. Nuremberg Code  
<http://ohsr.od.nih.gov/guidelines/nuremberg.html>
6. Declaration of Helsinki, World Medical Association  
<http://www.wma.net/en/30publications/10policies/b3/>
7. Belmont Report  
<http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html>

\* \* \*

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## **XVI. Community Eye Health**

*The resident should specifically reference their own country or health district as they consider each of the community health-related items presented below, as not all items may be relevant to each resident.*

### **Basic Level Goals: Year 1**

#### **A. Cognitive Skills**

##### **Principles for the prevention of blindness**

1. Explain the World Health Organization (WHO) definition of blindness and low vision.\*\*
2. Describe the magnitude of blindness in different economic settings.\*\*
3. List the major causes of blindness in different economic settings.\*\*
4. Describe the magnitude of blindness in the resident's own country.\*\*
5. List the major causes of blindness in the resident's own country.\*\*
6. Define the concept of blind-person years.\*\*
7. Outline the structure of the health service, and how eye care services are integrated into this structure.\*\*
8. Outline the social and economic implications of visual impairment and the impact on quality of life.\*\*
9. Outline the barriers to the uptake of eye care services.\*\*
10. Describe the principles of primary health care and their application for primary eye care.\*\*

##### **Inclusive practice**

1. Explain the WHO definition and conceptualization of disability.
2. Appraise the epidemiology of disability (including due to visual impairment) and its impact in different economic settings.
3. Describe the intersection of blindness and visual impairment with other issues that may cause marginalization, including the patient's age, gender, other impairments, poverty, ethnic group, and faith community.
4. Critically appraise the impact of disability in peoples lives (eg, poverty, education, quality of life [social and economic], and occupation).
5. Describe the barriers to the uptake of eye care services within health systems by marginalized groups.
6. Describe the principles of rehabilitation and community-based rehabilitation with relevance to people with visual impairment and the integration of rehabilitation within a health system.
7. Describe strategies and partnerships with disability support services that can improve quality of life (eg, health, education, livelihoods, economic security, social inclusion) of people with long term visual impairment.

##### **Cataract**

1. Describe the prevalence and incidence of blindness due to cataract.\*\*\*
2. Define cataract surgical rate (CSR).\*\*
3. Describe the desired CSR required to eliminate blindness due to cataract.\*\*
4. List the barriers to the uptake of cataract surgery.\*\*

5. Outline the rationale for the monitoring of cataract services.\*\*
6. Describe the components of a system for the monitoring of cataract services.\*\*
7. List the WHO's recommendations for the visual acuity outcomes following cataract surgery.\*\*

### **Refractive error**

1. Define significant refractive error.\*\*
2. Describe the prevalence of significant refractive error in children and in adults.\*\*
3. Outline the strategy for including refractive error in a blindness prevention program, including a system for screening of school children to detect refractive error.\*\*
4. List the barriers to the uptake of refractive error services.\*\*

### **Low vision**

1. Define low vision.\*\*
2. Describe the prevalence of low vision.\*\*
3. Outline the strategy for including low vision in a blindness prevention program.\*\*
4. List the barriers to the uptake of low vision services.
5. Describe the impact of low vision on the affected person and how it impacts their access to wider health, education, economic, and social inclusion.\*\*
6. List the resources available for people with low vision (eg, low-vision devices, low-vision training, and access to wider opportunities in education, livelihoods, and social inclusion).\*\*

### **Childhood blindness**

1. Define childhood blindness.\*\*
2. Describe the prevalence of childhood blindness in different economic settings.\*\*
3. Describe the incidence of childhood blindness.\*\*
4. Describe the classification of the causes of childhood blindness.\*\*
5. Outline the blind school survey method and the key informant method for identifying the causes of childhood blindness.\*\*
6. Summarize the results of blind school surveys that have been conducted.\*\*
7. List the barriers to the uptake of services for childhood eye problems.\*\*
8. Outline the role of primary eye care in the prevention and treatment of childhood blindness.\*\*
9. Outline how to partner with services that can improve quality of life (eg, health, education, livelihoods, and social inclusion) of children with long term visual impairment.

### **Trachoma**

1. Describe the risk factors for trachoma.\*\*
2. Outline the WHO clinical grading of trachoma.\*\*
3. Outline the surgery, antibiotics, facial cleanliness, and environmental changes (SAFE) strategy for the control of trachoma.\*\*
4. Describe the magnitude of trachoma, and describe the affected regions.\*\*
5. Outline the role of primary health care in the prevention and treatment of trachoma.\*\*

### **Onchocerciasis**

1. Describe the risk factors for onchocerciasis.\*\*
2. Outline the strategy for the control of onchocerciasis.\*\*
3. Describe the magnitude of onchocerciasis, and describe the affected regions.\*\*
4. Outline the system for the distribution of ivermectin.\*\*

### **Glaucoma**

1. Describe the prevalence of glaucoma and blindness due to glaucoma.\*\*

### **Diabetic retinopathy**

1. Describe the prevalence of diabetes and diabetic retinopathy.\*\*

### **Human resources for blindness prevention program**

1. Describe the role and distribution of different cadres working in eye care.\*\*

### **Planning of blindness prevention programs**

1. Describe the steps in developing a one-year operational plan for a blindness prevention program for a health district with a population of one million people.\*\*

## **B. Technical Skills**

### **Principles of prevention of blindness**

1. Calculate prevalence rates from given data sets.\*\*
2. Calculate numbers blind from given prevalence rates.\*\*
3. Calculate blind-person years from given data sets.\*\*
4. Calculate estimates of numbers of persons who are blind.\*\*
5. Calculate estimates of blind-person years.\*\*
6. Calculate an estimate of the number of persons who are irreversibly blind and require rehabilitation services.

### **Cataract**

1. Calculate an estimate of the number blind due to cataract.\*\*
2. Calculate cataract surgery rate.\*\*
3. Calculate cataract surgery coverage from given data sets.\*\*
4. Calculate and comment on visual acuity outcomes following cataract surgery from given data sets.\*\*

### **Refractive error**

1. Calculate estimates of numbers of children and adults with significant refractive error.\*\*

### **Low vision**

1. Calculate estimates of numbers of children and adults with low vision.\*\*

### **Childhood blindness**

1. Calculate estimates of the numbers of children blind due to different causes.\*\*

## **Standard Level Goals: Year 2**

### **A. Cognitive Skills**

#### **Principles for the prevention of blindness**



1. Outline the magnitude and distribution of global blindness, and compare this to overall global disability prevalence.
2. List the major causes of global blindness.
3. Describe primary, secondary, and tertiary prevention strategies that are applicable to the leading causes of low vision and blindness.
4. Outline the different possible approaches (ie, disease orientated, service orientated, strategy orientated, community orientated) to blindness prevention.
5. Describe the integrated approach to blindness prevention that is recommended for use in VISION 2020.
6. Describe the structure and function of a generic VISION 2020 program for a health service unit with a population of one million.
7. In line with the WHO [Universal Eye Health: A Global Action Plan 2014–2019](#), describe strategies to strengthen inclusive practices related to gender, disability, and other groups within a generic VISION 2020 program.

#### **Cataract**

1. Describe the prevalence and incidence of blindness due to cataract in different economic settings.
2. Describe the cataract surgery rates in different economic settings.
3. Describe cataract surgery coverage, including its use and limitations as an indicator to measure program output.
4. Outline the possible strategies to overcome the barriers to cataract surgery.
5. Define cataract surgery efficiency and cataract surgery volume.
6. Outline the factors affecting cataract surgery capacity.
7. Outline the principles of an efficient cataract surgical service.
8. Describe a model for the staffing and running of a cataract surgical unit.
9. Describe the components of a model for the costing of cataract surgery.
10. Describe the possible strategies for cataract surgery cost containment.
11. Describe the possible strategies for cataract surgery cost recovery.

#### **Refractive error**

1. Describe the prevalence of refractive error in different countries/regions.
2. Outline the possible strategies for the provision of spectacles in a blindness prevention program.

#### **Low vision**

1. Describe the prevalence of low vision in different countries/regions.
2. Outline the possible strategies for the provision of low-vision aids in a blindness prevention program.

#### **Childhood blindness**

1. List the main causes of childhood blindness in different socioeconomic settings.
2. Describe the primary, secondary, and tertiary prevention strategies for the control of childhood blindness due to corneal scar, cataract, glaucoma, and retinopathy of prematurity.
3. Describe the main barriers for children with visual disabilities to access health, education, and social inclusion.
4. Outline the models/strategies for supporting education for children with visual impairments through mainstream schools (eg, inclusive education) or “special” schools.

#### **Glaucoma**

1. Describe the prevalence of glaucoma in different regions and in different race groups.
2. Outline the possible strategies for the opportunistic case detection of glaucoma.
3. Describe the advantages and disadvantages of medical, laser, and surgical interventions for the management of glaucoma in middle and low-income countries.
4. Define glaucoma treatment/surgery rate.
5. If known, describe the desired glaucoma treatment/surgery rate that is required to adequately deal with glaucoma in a blindness prevention program.
6. Outline the possible strategies for increasing the glaucoma follow-up rate.

#### **Diabetic retinopathy**

1. Outline the possible strategies for the prevention of diabetic retinopathy, including the use of appropriate educational health materials for counseling.
2. Outline the possible strategies for screening for diabetic retinopathy.
3. Outline the possible strategies for the treatment of diabetic retinopathy.
4. Outline the possible strategies for increasing the diabetic retinopathy follow-up rate.

#### **Human resources for blindness prevention programs**

1. Describe the recommended cadres and numbers of human resources required at the community level, primary level, secondary level, and tertiary level for a generic blindness prevention program for a health service unit of one million in the resident's own country or health district.
2. Describe the roles of each of the cadres that are recommended for a generic blindness prevention program.
3. Describe the available training facilities for a generic blindness prevention program.

#### **Infrastructure for blindness prevention programs**

1. From the International Agency for the Prevention of Blindness (IAPB) standard list for VISION 2020, describe the recommended instruments and equipment required at the primary, secondary, and tertiary level for a generic blindness prevention program for a health service unit of one million population.
2. Outline the strategies for the maintenance of the recommended instruments and equipment.

#### **Planning of blindness prevention programs**

1. Describe the potential role of a VISION 2020 coordinator and a VISION 2020 committee.

### **B. Technical Skills**

#### **Principles of blindness prevention**

1. For planning purposes, integrate primary, secondary, and tertiary preventions for leading causes of low vision and blindness into a district blindness prevention program plan adhering to inclusive practices.

#### **Cataract**

1. For planning purposes, calculate estimates of numbers of people blind due to cataract in different countries and regions.
2. For planning purposes, calculate cataract surgery rate in different countries and regions.
3. For planning purposes, identify and include suitable strategies for overcoming the barriers to cataract surgery in a blindness prevention program. Consider how patients may be affected differently based on their age, gender, other impairments, poverty, ethnic group, faith community, etc.

4. For planning purposes, identify and include suitable strategies for improving the efficiency of a cataract surgical unit in a blindness prevention program.

#### **Refractive error**

1. Calculate estimates of numbers of children and adults with significant refractive error in different countries and regions.
2. For planning purposes, identify and include suitable strategies for including refractive error as a priority in a blindness prevention program.

#### **Low vision**

1. Calculate estimates of numbers of children and adults with low vision in different countries and regions.
2. For planning purposes, identify and include suitable strategies for including low vision as a priority in a blindness prevention program.

#### **Childhood blindness**

1. For planning purposes, use available program reports to identify key gaps in and barriers to service delivery.

#### **Trachoma**

1. For planning purposes, use available program reports to identify key gaps in and barriers to service delivery.

#### **Onchocerciasis**

1. For planning purposes, use available program reports to identify key gaps in and barriers to service delivery.

#### **Glaucoma**

1. Calculate estimates of numbers of people with glaucoma in different countries and regions.
2. For planning purposes, identify and include suitable strategies for including glaucoma as a priority disease in a blindness prevention program.

#### **Diabetic retinopathy**

1. Calculate estimates of numbers of people with diabetic retinopathy in different countries and regions.
2. For planning purposes, identify and include suitable strategies for including diabetic retinopathy as a priority disease in a blindness prevention program.

#### **Human resources**

1. For planning purposes, identify and include suitable strategies for improving the human resource capacity in a blindness prevention program.

#### **Infrastructure**

1. For planning purposes, identify and include suitable strategies for improving the infrastructure capacity in a blindness prevention program.

#### **Planning of blindness prevention programs**

1. Develop an activities plan for a one-year operational plan for a blindness prevention program for a health district with a population of one million.

### **Advanced Level Goals: Year 3**

#### A. Cognitive Skills

##### **Principles of prevention of blindness**

1. Outline the different health service models in different countries and regions, and how eye care services might be integrated into these.
2. Describe the components of a rapid assessment of avoidable blindness (RAAB) survey.
3. Outline the government and nongovernment funding that are available for eye care.
4. Describe the key practices and policies that will ensure the principles of prevention of blindness are inclusive relating to gender, disability, and other potential causes of marginalization.

#### **Cataract**

1. Outline the components of a system for monitoring the visual acuity outcomes following cataract surgery.
2. Outline the components of the cataract surgery costs.

#### **Trachoma**

1. Describe the components of a rapid assessment of trachoma (RAT) survey.

### **B. Technical Skills**

#### **Cataract**

1. Set up a system for the monitoring of the visual acuity outcomes following cataract surgery.
2. Calculate cataract surgery costs with recommendations for strategies to decrease unit costs.

#### **Refractive error**

1. Evaluate the coverage and impact of school screening, and make recommendations for improvement.
2. Evaluate the services for the provision of presbyopic correction, and make recommendations for improvement.

#### **Low vision**

1. Evaluate the coverage and impact of low-vision services.

#### **Childhood blindness**

1. Where appropriate, set up a system for the screening and treatment of retinopathy of prematurity.

#### **Trachoma**

1. Where appropriate, network and advocate with agencies and communities to implement the F (facial cleanliness) and E (environmental changes) components in the SAFE strategy.

#### **Planning of blindness prevention programs**

1. Develop a budget for a one-year operational plan for a blindness prevention program for a health district with a population of one million.

### **Very Advanced Level Goals: Subspecialist**

*Subspecialty training usually involves a 1-2 year master's level training in community eye health. This might be a stand-alone master's degree in community eye health, or it might be a component of a master in public health degree. A community eye health subspecialist should have all the cognitive and technical skills listed for residency training. A community eye health subspecialist should be able to plan and manage a district or national blindness prevention program.*

## A. Cognitive Skills

*In addition to the cognitive skills listed for residency training, be able to:*

1. Describe the principles of epidemiology, as applicable to community eye health.
2. Describe the principles of research methods, as applicable to community eye health.
3. Describe the principles of biostatistics, as applicable to community eye health.
4. Describe the principles of health economics, as applicable to community eye health.
5. Describe the principles of health systems strengthening, as applicable to community eye health.
6. Describe the principles of health education and health promotion, as applicable to community eye health.
7. Describe the principles of project and program management, as applicable to community eye health.
8. Describe the relevant WHO global programs (eg, millennium development goals, disability framework).
9. Describe the relevance of the disability policy at a global level and within the health system.
10. Describe the main concepts of habilitation, rehabilitation, and community based rehabilitation for persons with visual disability and its integration within a health system.

## B. Technical Skills

*In addition to the technical skills listed for residency training, be able to:*

1. Plan and conduct research projects to inform the planning and implementation of district and national blindness prevention programs.
2. Plan and conduct RAAB surveys.
3. Plan and conduct RAT surveys.
4. Plan, implement, and manage one-year district operational blindness prevention programs.
5. Plan, implement, and manage national three-to-five-year strategic blindness prevention programs.
6. Advocate for national policy implementation and community participation to strengthen national blindness prevention programs.
7. Provide training in community eye health to different eye care cadres.
8. Engage with public health practitioners to advocate for improvements in eye care services and the implementation of the disability framework.
9. Assess the impact of disabilities and advocate the application of global disability policy at a local level.

\* \* \*

**Note:** *Inclusion of therapies and investigations in the ICO Residency Curriculum does not imply that listings are all inclusive or that methods are endorsed by the ICO. Appropriate levels of expertise and knowledge should be achieved based on the care provided. Practitioners should know of therapies and investigations not available at their hospital or clinic, so that they can advise patients who may be able to seek care elsewhere.*

## **XVII. Appendix**

### **Residency Curriculum**

#### **Chair, Section Chairs, and Committee Members**

Andrew G. Lee, MD, **Chair**, United States

#### **I. Optics and Refraction**

Florence Malet, MD, **Section Chair**, France  
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Doğan Ceyhan, MD, Member, Turkey  
Berthold Seitz, MD, EBOD, Member, Germany

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Anders Behndig, MD, PhD, Member, Sweden  
Zsolt Biró, MD, PhD, Member, Hungary  
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Guy Kleinmann, MD, Member, Israel

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Deepinder K. Dhaliwal, MD, Member, United States  
Albert T. Franceschetti, MD, Member, Switzerland  
Ayfer Kanpolat, MD, Member, Turkey  
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#### **IV. Cornea and External Diseases**

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D. Ramamurthy, MD, DNB, Member, India  
Rasik B. Vajpayee, MS, FRCS (Edin), FRANZCO, Member, Australia

#### **V. Refractive Surgery**

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Gustavo E. Tamayo Fernández, MD, **Co-Section Chair**, Colombia  
Joseph Colin, MD, Member, France  
Paolo Vinciguerra, MD, Member, Italy

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Robert Ritch, MD, Member, United States  
Fotis Topouzis, MD, Member, Greece

**VII. Neuro-Ophthalmology**

Aki Kawasaki, MD, **Section Chair**, Switzerland,  
Carlos Filipe Chicani, MD, Member, Brazil  
Şansal Gedik, MD, Member, Turkey  
Sanjeev Yawanarajah, MD, Member, Malaysia

**VIII. Ophthalmic Pathology**

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Juan O. Croxatto, MD, Member, Argentina  
Ahmad M. Mansour, MD, Member, Lebanon  
Geeta K. Vemuganti, DCP, MD, DNB, Member, India

**IX. Oculoplastic Surgery and Orbit**

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Daniel Briscoe, MD, Member, Israel  
Christian E. Decock, MD, Member, Belgium

**X. Pediatric Ophthalmology and Strabismus**

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Swaminathan Meenakshi, MD, **Co-Section Chair**, India  
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**XI. Vitreoretinal Diseases**

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**XIV. Low Vision Rehabilitation**

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**XV. Ethics and Professionalism in Ophthalmology**

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### V. Refractive Surgery

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**XI. Vitreoretinal Diseases**

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**XII. Uveitis and Ocular Inflammation**

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**XIV. Low Vision Rehabilitation**

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**XV. Ethics and Professionalism in Ophthalmology**

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**XVI. Community Eye Health**

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## References

*Evidence-based medicine, in which therapeutic decisions are based on documented, verifiable, and validated information, is an increasingly important educational framework upon which physicians should make recommendations for their patients. Whenever possible, updated references and sources of knowledge providing such information should receive precedence and preference by both teachers and students of clinical ophthalmology. Links to the practice of evidence-based medicine can be found at [www.aao.org](http://www.aao.org).*

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### Websites

1. International Council of Ophthalmology (ICO): [www.icoph.org](http://www.icoph.org)
  - a. ICO Center for Ophthalmic Educators: [educators.icoph.org](http://educators.icoph.org)
  - b. ICO Examinations: [www.icoexams.org/](http://www.icoexams.org/)

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[www.icoph.org/refocusing\\_education/fellowships.html](http://www.icoph.org/refocusing_education/fellowships.html)
- d. ICOFoundation: [www.icofoundation.org/](http://www.icofoundation.org/)
- 2. American Academy of Ophthalmology: <http://www.aao.org>
- 3. American Academy of Ophthalmology Education Resource Center:  
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- 4. American Board of Ophthalmology: <http://www.abop.org>
- 5. Digital Journal of Ophthalmology: <http://www.djo.harvard.edu>
- 6. Eye Search: <http://www.eyesearch.com>
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- 8. Eye Cancer Network: <http://eyecancer.com>
- 9. Eye Library.Org: <http://www.eyelibrary.org>
- 10. Eye Text.Net: <http://www.eyetext.net>
- 11. Accreditation Council for Graduate Medical Education: <http://www.acgme.org>
- 12. Orbis International: [www.orbis.org](http://www.orbis.org)
- 13. Ophthalmic resource searches (ie, search for "eye resources on the Internet" or search by ophthalmic keywords): <http://www.google.com>
- 14. New York Eye and Ear Infirmary: Digital Atlas of Ophthalmology  
[http://www.nyee.edu/page\\_deliv.html?page\\_no=50](http://www.nyee.edu/page_deliv.html?page_no=50)
- 15. Royal College of Ophthalmologists: <http://www.rcophth.ac.uk>
- 16. Royal Australian and New Zealand College of Ophthalmology: <http://www.ranzco.edu>
- 17. Wilmer Ophthalmological Institute: <http://www.wilmereyeyeinstitute.net>

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- 2. American Journal of Ophthalmology: <http://www.ajo.com>
- 3. Ophthalmology: <http://www.aao.org>
- 4. Several sub-specialty journals are available through: <http://www.ophsource.org>
- 5. Archives of Ophthalmology: <http://archophth.ama-assn.org/>
- 6. British Journal of Ophthalmology: [www.bjophthalmol.com](http://www.bjophthalmol.com)
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## I. Optics and Refraction

### Publications

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<http://disorders.eyes.arizona.edu/>
3. University of Iowa Hospital and Clinics Eye Rounds  
<http://webeye.ophth.uiowa.edu/eyeforum/atlas/indexes/Cornea.html>
4. University of Iowa Hospital and Clinics Eye Rounds – Case Presentations  
<http://webeye.ophth.uiowa.edu/eyeforum/cases.htm> (Cornea and Anterior Segment tab)
5. Columbia Digital Reference of Ophthalmology Cornea and External Disease  
<http://dro.hs.columbia.edu/ced1.htm>
6. Online Journal of Ophthalmology Atlas of Ophthalmology - Cornea  
<http://www.atlasophthalmology.com/atlas/folder.jsf?node=922&locale=en>

### Suggested Journals

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<http://journals.lww.com/corneajrnl/pages/default.aspx>
2. Journal of Cataract and Refractive Surgery  
<http://ees.elsevier.com/jcrs/>  
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### **Online Education**

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2. American Academy of Ophthalmology EyeWiki – refractive Management and Intervention: [http://eyewiki.aao.org/Category:Refractive\\_Management/Intervention](http://eyewiki.aao.org/Category:Refractive_Management/Intervention)
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### **Suggested Journals**

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## **IX. Oculoplastic Surgery and Orbit**

### **Recommended Textbooks**

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4. The AAO Basic and Clinical Science Course section 6: Pediatric ophthalmology and strabismus.

### **Free Textbooks Available at Orbis: [www.cybersight.org](http://www.cybersight.org)**

1. von Noorden and Campos: Binocular Vision and Ocular Motility.
2. Helveston: Surgical Management of Strabismus.
3. Von Noorden and Helveston: Strabismus: A Decision Making Approach.

### **Pediatric Ophthalmology and Strabismus Journals**

1. Journal of AAPOS
2. Journal of Pediatric Ophthalmology and Strabismus
3. The American Orthoptic Journal
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## **XI. Vitreoretinal Diseases**

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## **XII. Uveitis and Ocular Inflammation**

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### **XIII. Ocular Oncology**

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2. WMA Declaration of Geneva  
<http://www.wma.net/en/30publications/10policies/g1/>
3. Ethical Code, International Council of Ophthalmology  
<http://www.icoph.org/pdf/icoethicalcode.pdf>
4. Code of Ethics, American Academy of Ophthalmology  
[http://www.aaopt.org/about/ethics/code\\_ethics.cfm](http://www.aaopt.org/about/ethics/code_ethics.cfm)
5. Nuremberg Code  
<http://ohsr.od.nih.gov/guidelines/nuremberg.html>
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