

A national curriculum for ophthalmology residency training

Ashok Kumar Grover, Santosh G Honavar¹, Rajvardhan Azad², Lalit Verma³

We present a residency curriculum for Ophthalmology in India. The document derives from a workshop by the All India Ophthalmological Society (AIOS) which adapted the International Council of Ophthalmology residency curriculum and refined and customized it based on inputs by the residency program directors who participated in the work shop. The curriculum describes the course content, lays down the minimum requirements of infrastructure and mandates diagnostic and therapeutic procedures required for optimal training. It emphasises professionalism, management, research methodology, community ophthalmology as integral to the curriculum. The proposed national ophthalmology residency curriculum for India incorporates the required knowledge and skills for effective and safe practice of ophthalmology and takes into account the specific needs of the country.

Key words: Curriculum, infrastructure requirements, ophthalmology, postgraduate training, residency

Residency in Ophthalmology prepares a trainee to be a safe, independent practitioner in the specialty. A number of communications¹⁻⁷ have pointed to the limitations of the present residency training in India. A prime prerequisite to bringing about a change in the situation is to have a vibrant, up-to-date curriculum. The All India Ophthalmological Society (AIOS) recognized the importance of a well-structured curriculum for residency training in the country. A workshop for the development of a national curriculum for Ophthalmology was organized in New Delhi on January 3, 2011, with Dr. R. V. Azad, Dr. A. K. Grover, and Dr. Lalit Verma in the chair and Dr. Santosh G. Honavar as the program convener. The workshop was attended by experts from all over the country. The invitees included representatives of postgraduate (PG) training institutions from the government and the private sector and faculty from various subspecialties of Ophthalmology. The group prepared a consensus document adapting the residency curriculum of the International Council of Ophthalmology (ICO)⁸ based on the Indian needs. The document constituted a valuable input to the curriculum committees of the Medical Council of India and the National Board of Examination (one of the authors [AKG] was a member) in making their recommendations.

This communication presents the recommendations modified by some later inputs which may be of interest to the institutions involved with the residency training in the country.

The curriculum documents the required knowledge and skills for effective and safe practice of ophthalmology. It takes into account the social milieu and disease pattern in the country.

Vision Eye Centre Pvt. Ltd., ³Centre for Sight, New Delhi, ¹Raj Retina and Eye Care Centre, Patna, Bihar, ²Centre for Sight, Hyderabad, Telangana, India

Correspondence to: Dr. Ashok Kumar Grover, Vision Eye Centre Pvt. Ltd., 19, Siri Fort Road, New Delhi - 110 049, India. E-mail: akgrover55@yahoo.com

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It emphasizes the dynamic nature of the curriculum that keeps pace with the developments and advances around the world. The document stresses the importance of evidence-based medicine. The curriculum lays down the minimum requirements of infrastructure for ophthalmic services and education. The curriculum lays emphasis on research methodology, ethics, and professionalism as well as community ophthalmology. It recommended that management including hospital management, practice management, and financial management should form a part of the curriculum. It outlines the requirements of tools and resources for training and the human resource requirements.

The curriculum outlines the course content, which includes the cognitive and technical skills required by a comprehensive ophthalmologist. These have been classified into basic-level goals (PG year [PGY] 1), standard-level goals (PGY 2), and advanced-level goals (PGY 3). There are some repetitions within the standard and advanced levels because some areas are important enough to deserve this emphasis. It has put down the minimum required diagnostic, therapeutic, and surgical procedures that a resident must perform during his/her period of training. The curriculum lays stress on the assessment of residents' training through rubrics for the assessment of surgical skills (Ophthalmology Surgical Competency Assessment Rubric [OSCAR]) and ophthalmic clinical evaluation exercise (OCEx) as adapted from the curriculum of the ICO. Concurrent assessment including maintenance of logbooks and internal examinations has been stressed.

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Recommendations for the structure of an exit examination have also been outlined in the document. The curriculum also includes a list of books, journals, and websites, which could be useful educational resources.

These are aspirational guidelines which may be modified according to regional and local priorities. A need for regular updating is stressed.

Guidelines for Competency-based Postgraduate Training Program for MS in Ophthalmology

Preamble

The purpose of this program is to standardize ophthalmology teaching at PG level throughout the country so that it will benefit in achieving uniformity in teaching as well as result in creating competent ophthalmic surgeons with appropriate expertise. As a licensed medical doctor, the ophthalmologist's ethical and legal responsibilities include the care of individuals and populations suffering from disorders of the eye and visual system. Such care requires not only core competencies for an ophthalmic physician but also a set of specialized cognitive capabilities and an array of technical skills. Specialist training is designed to provide a structured program of learning that facilitates the acquisition of knowledge, understanding, skills, and attitudes to a level appropriate for an ophthalmic specialist who has been fully prepared to begin his/her career as an independent consultant in ophthalmology.

Blindness and reduced vision affect hundreds of millions of people throughout the world, and the causes vary widely. The knowledge required to understand and treat the diseases commonly encountered in one part of the country may be entirely different from that required in other locations. Accordingly, the curricular components deemed essential in one geographical locale or one cultural system may be relatively unimportant in other regions, depending upon the prevalence of diseases, medical infrastructure, and other factors.

Levels of economic and social development also vary widely throughout the country. Treatments and techniques considered indispensable for one group of people might be unattainable or unimportant for others, due to lack of economic resources, unavailability of highly specialized personnel or equipment, and many other factors. Thus, the standards proposed herein should be considered as aspirational guidelines to be sought and attained as soon as practicable. They cannot be instantly achieved in all parts of the country, desirable as they might be. Standards may need to be modified according to local priorities, goals, needs, culture, governmental policies, social systems, financial constraints, varying use of paraophthalmic personnel, and differing tangible resources. This document should be considered a "work in progress" and be revised and modified to suit local needs as well as respond to expanding knowledge and technology.

Practice-based learning and improvement

Residents must be able to investigate and evaluate their patient care practices, to appraise and assimilate scientific evidence, and to improve their patient care practices. Residents are expected to:

- Analyze practice experience and perform practice-based improvement activities using a systematic methodology
- Locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems

- Obtain and use information about their own population of patients and the larger population from which their 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
- Use information technology to manage information, access online medical information, support their own education, and facilitate the learning of students and other health-care professionals.

Interpersonal and communication skills

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange and teaming with patients, patients' families, and professional associates. Residents are expected to:

- 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
- Work effectively with others as a member or leader of a health-care team or other professional groups.

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. Residents are expected to:

- Demonstrate respect, compassion, and integrity; a responsiveness to the needs of patients and society that supersedes self-interest; an accountability to patients, society, and the profession; and a commitment to excellence and ongoing professional development
- Demonstrate a commitment to the ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent, and business practices
- Demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities.

Systems-based practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of healthcare and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

- Understand how their patient care and other professional practices affect other health-care professionals, health-care organization, and larger society and how these elements of the system affect their own practice
- Know how types of medical practice and delivery systems differ from one another, including methods of controlling health-care costs and allocating resources
- 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
- 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.

Professional attitudes and conduct require that trainees must also have developed a style of care, which is:

- Humane (reflecting compassion in providing bad news, if necessary; management of the visually impaired; and recognition of the impact of visual impairment on the patient and society)
- Reflective (including recognition of the limits of their knowledge, skills, and understanding)
- Ethical
- Integrative (including involvement in an interdisciplinary team for the eye care of children, disabled, systemically ill, and elderly)
- Scientific (including critical appraisal of the scientific literature, evidence-based practice, and use of information technology and statistics).

Subject Specific Goals and Learning Objectives

Program goals

A candidate upon successfully qualifying in the Ophthalmology residency examination should be able to:

- a. Offer to the community, the current quality of "standard of care" in ophthalmic diagnosis, as well as therapeutics, medical or surgical, in most of the common situations encountered at the level of health services
- b. Periodically self-assess his or her performance and keep abreast with ongoing advances in the field and apply the same in his/her practice
- c. Be aware of his/her own limitations to the application of the specialty in situations which warrant referral to more qualified centers or individuals
- d. Apply research and epidemiological methods during his/her practice. The candidate should be able to present or publish work done by him/her
- e. Contribute as an individual/group toward the fulfillment of national objectives with regard to prevention of blindness
- f. Effectively communicate with patients or relatives so as to educate them sufficiently and give them the full benefit of informed consent to treatment and ensure compliance.

Specific learning objectives

The clinical residency training programs are intended at developing in a student a blend of qualities that of a clinical specialist, a teacher, and a researcher. These programs are organized such that a resident should possess the following qualities, knowledge, and skills:

- a. He/she should possess basic knowledge of the structure, function, and development of the human body as related to ophthalmology, of the factors which may disturb these mechanisms and the disorders of structure and function which may result thereafter
- b. He/she should be able to practice and handle most day-to-day problems independently in ophthalmology. He/she should recognize the limitations of his/her own clinical knowledge and know when to seek further help
- c. He/she should understand the effects of environment on health and be familiar with the epidemiology of at least the more common diseases in the field of ophthalmology. He/she should be able to integrate the preventive methods with the curative and rehabilitative measures in the comprehensive management of the disease
- d. He/she should be familiar with common eye problems occurring in rural areas and be able to deal with them effectively. He/she should also be made aware of mobile

- e. ophthalmic unit and its working and components
- e. He/she should be familiar with the current developments in ophthalmic sciences
- f. He/she should be able to plan educational programs in ophthalmology in association with his/her senior colleagues and be familiar with the modern methods of teaching and evaluation
- g. He/she should be able to identify a problem for research, plan a rational approach to its solution, execute it, and critically evaluate his/her data in the light of existing knowledge
- h. He/she should reach the conclusions by logical deduction and should be able to assess evidence both as to its reliability and its relevance
- i. He/she should have basic knowledge of medicolegal aspects of medicine
- j. He/she should be familiar with patient counseling and proper consent taking
- k. Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange and teaming with patients, patients' families, and professional associates. Residents are expected to:
 - 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
 - Work effectively with others as a member or leader of a health-care team or other professional groups
- l. Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population as laid down under professionalism in the preamble.

Curriculum

The following overall objectives are expected to be achieved by the end of 3 years of instructions and residential training program. It is strongly recommended that the existing diploma seats in medical colleges be converted to MS/MD degree programs as 2 years is inadequate to acquire the knowledge and the necessary skills. The details are listed assignment-wise:

Basic medical sciences

- Attain understanding of the structure and function of the eye and its parts in health and disease
- Attain understanding and application of knowledge of the structure and function of the parts of central nervous system and other parts of the body with influence or control on the structure and function of the eye
- Attain understanding of and develop competence in executing common general laboratory procedures employed in diagnosis and research in ophthalmology.

Clinical ophthalmology

Given adequate opportunity to work on the basis of graded responsibilities in outpatients, inpatients, and operation theaters on a rotational basis in the clinical sections from the day of entry to the completion of the training program, the students should be able to:

- Acquire scientific and rational approach to the diagnosis of ophthalmic cases presented
- Acquire understanding of and develop inquisitiveness to investigate to establish cause and effect of the disease

- Manage and treat all types of ophthalmic cases
- Competently handle and execute safely all routine surgical procedures on lens, glaucoma, lid, sac, adnexa, retina, and muscle anomalies
- Competently handle all ophthalmic medical and surgical emergencies
- Be familiar with microsurgery and special surgical techniques
- Demonstrate knowledge of the pharmacological (including toxic) aspects of the drugs used in ophthalmic practice and drugs commonly used in general diseases affecting the eyes.

Refraction

- Acquire competence in the assessment of refractive errors and prescription of glasses for all types of refraction problems
- Acquire basic knowledge of manufacture and fitting of glasses and competence of judging the accuracy and defects of the dispensed glasses.

Ophthalmic subspecialties

Given an opportunity to work on a rotational basis in various special clinics of subspecialties of ophthalmology, if possible, the student should be able to:

- Examine, diagnose, and demonstrate understanding of management of the problems of neuro-ophthalmology and refer appropriate cases to neurology and neurosurgery
- Examine, diagnose, and demonstrate understanding of management of (medical and surgical) complicated problems in the field of (a) lens, (b) glaucoma, (c) cornea, (d) retina, (e) pediatric ophthalmology, (f) oculoplasty, (g) uvea, and (i) genetic problems in ophthalmology
- Demonstrate understanding of the manufacture and competence in prescription and dispensing of contact lenses (CLs) and ocular prosthesis.

Ophthalmic pathological/microbiological/biochemical sciences

- Be able to interpret the diagnosis in correlation with clinical data and routine materials received in such cases.

Community ophthalmology

Eye screening camps may be conducted where residents are posted for being imparted training according to a set methodology. The community and school surveys may also be conducted by the residents.

The residents are given an opportunity to participate in surveys and eye camps. They should be able to guide rehabilitation workers in the organization and training of the blinds in art of daily living and in the vocational training of the blind leading to gainful employment.

Research

- Recognize a research problem
- State the objectives in terms of what is expected to be achieved in the end
- Plan a rational approach with appropriate controls with full awareness of the statistical validity of the size of the material
- Spell out the methodology and carry out most of the technical procedures required for the study
- Accurately and objectively record on systematic lines results and observation made
- Analyze the data with the aid of appropriate statistical analysis

- Interpret the observations in the light of existing knowledge and highlight in what ways the study has advanced existing knowledge on the subject and what further remains to be done
- Write a thesis in accordance with the prescribed instructions
- Write at least one scientific paper as expected of International Standards from the material of this thesis.

Management

- Practice and hospital management
- Financial management.

Curriculum Contents

These are only broad guidelines and are illustrative; there may be overlap between sections.

Basic sciences

1. Orbital and ocular anatomy
 - a. Gross anatomy
 - b. Histology
 - c. Embryology
2. Ocular physiology
3. Ocular pathology
4. Ocular biochemistry

General biochemistry, biochemistry applicable to ocular function
5. Ocular microbiology

General microbiology, specific microbiology applicable to the eye
6. Immunology with particular reference to ocular immunology
7. Genetics in ophthalmology.

Optics

1. Basic physics of optics
2. Applied ophthalmic optics
3. Applied optics including optical devices
4. Disorders of refraction.

Clinical ophthalmology

1. Disorders of the lids
2. Disorders of the lacrimal system
3. Disorders of the conjunctiva
4. Disorders of the sclera
5. Disorders of the cornea
6. Disorders of the uveal tract
7. Disorders of the lens
8. Disorders of the retina
9. Disorders of the optic nerve and visual pathway
10. Disorders of the orbit
11. Glaucoma
12. Neuro-ophthalmology
13. Pediatric ophthalmology
14. Ocular involvement in systemic disease
15. Immune ocular disorders
16. Strabismus and amblyopia.

The desired scope of various aspects in the course content has been outlined in Annexure 1 (including basic-, standard-, and advanced-level goals).

Medical ethics and professionalism

Basic-level goals: Postgraduate (PG) year 1

1. Describe the fundamentals and principles of medical ethics in ophthalmology (e.g., patient care decision-making,

- informed consent, competency issues, ethics of intercollegial relations, risk management, and privacy issues)
- Describe the basics of ophthalmic practice management (e.g., contractual negotiations, hiring and supervising employees, financial management, working with associates, and billing/collecting)
 - Describe the basics of the health-care system and reimbursement, as appropriate to the local, regional, and national market of the trainee (e.g., third-party payers, managed care, medical documentation, private insurance, and nationalized healthcare systems).

Standard-level goals: Postgraduate year 2

- Describe and apply more advanced principles of medical ethics (e.g., life and death patient care decision-making, ethics of optometric and nonphysician relations, documentation requirements, insurance claims, and risk management)
- Describe and apply more advanced aspects of practice management (e.g., business models, documentation requirements and coding, privacy requirements, and dealing with patients or employees with disabilities)
- Describe and apply more advanced aspects of health-care reimbursement (e.g., physicians' role in managed care organizations, administrative role, and third-party reimbursement).

Advanced-level goals: Postgraduate year 3

- Demonstrate proficiency in more advanced principles of medical ethics (e.g., informed consent in children, mentally ill, disabled, or demented patient; physician and industry relationships; acceptance and disclosure of gifts or consultation fees)
- Utilize in clinical practice the principles of practice management (e.g., starting a practice, economics of starting a practice, licensing and credentialing applications)
- Utilize in clinical practice the more advanced aspects of health-care reimbursement (e.g., denials of claims, hospital contracting, and electronic billing).

Community ophthalmology

The MS Ophthalmology curriculum should include:

- Initial training in the Final year – lecture and practical treatment of eye ailments – in the base hospital, with stress on comprehensive eye care in patient evaluation
Later on, postings in the last 6 months of their program should be in the community in the form of once a week postings in the primary health centers (PHCs) (for 3 months – totally 12 working days) that come under the umbrella of the respective medical colleges. This will improve the candidates' awareness of the scenario at the community level and also improve the level of eye care in the villages, thereby helping in the prevention of blindness in the country
- Topics to cover
 - National Programme for Control of Blindness
 - National Rural Health Mission policies
 - Cataract surgical rate and cataract incidence in India
 - Vision 2020
- The candidates to be given exposure to national and international agencies involved in the prevention of blindness
- Exposure to biostatistics' lectures and data analysis of their own surgical results

- Exposure to vision screening in schools and modern cataract surgical techniques in base hospital
- Exposure to computers and basic awareness of Word, Excel, and PowerPoint usage
- Awareness and exposure to Master of Public Health programs
- Training in public health education in campsites
- Eye banking

Research methodology

Following are the topics in Research Methodology which should be in the 1st year of residency ophthalmology curriculum as they will help in the conduction of thesis as well as reading and writing of papers in a proper manner.

- Introduction to evidence-based medicine and research methodology
- Ethics in research
- Proper literature search
- Framing a research question
- Various study designs
- Qualitative research/epidemiological studies/development of tools for quality of life and studies related to social issues
- Concept of population, concept of sample, sample size calculation
- Basics of statistics
 - Types of data
 - Central tendency and spread of data
 - Understanding *P* value
 - Standard error of mean (SEM) and confidence interval
- Hypothesis testing
 - Concept of null hypothesis and alternate hypothesis
 - Type I error
 - Type II error
 - Power of study
 - Various statistical tests
- Understanding various terminologies
 - Risk ratio
 - Odds ratio
 - Sensitivity
 - Specificity
 - Positive predictive value
 - Negative predictive value
 - Receiver operator curve (ROC)
 - Area under ROC
 - Risk reduction
 - Absolute risk reduction
 - Number needed to treat
 - Number needed to harm
- Protocol writing
- Scientific writing
- How to read and review a paper (critical appraisal).

Subject Specific Practice-Based or Practical Competencies

Essential diagnostic skills and minimum expectations for procedures

The minimum required procedures are listed in brackets (). These procedures should be a part of the logbook to ensure compliance.

Examination techniques along with interpretation

- Slit-lamp examination
 - Diffuse examination

- Focal examination
 - Retroillumination – Direct and indirect
 - Sclerotic scatter
 - Specular reflection
 - Staining modalities and interpretation
2. Fundus evaluation
 - Direct/indirect ophthalmoscopy
 - Fundus drawing
 - Three-mirror examination of the fundus
 - 78-D/90-D/60-D examination
 - Amsler charting.

Basic investigations along with their interpretation

1. Tonometry
 - Applanation (25)/indentation (25)/noncontact
2. Gonioscopy (25)
 - Indentation gonioscopy grading of the anterior-chamber (AC) angle
3. Tear/lacrimal function tests
 - Staining – Fluorescein and Rose Bengal (30)
 - Schirmer test/tear film breakup time (30)
 - Syringing (30)
 - Dacrocystography
4. Cornea
 - Corneal scraping and cauterization (10)
 - Smear preparation and interpretation (Gram's stain [20]/KOH [20])
 - Media inoculation
 - Keratometry – Performance and interpretation (25)
 - Pachymetry
 - Corneal topography – If available
5. Color vision evaluation
 - Ishihara pseudoisochromatic plates
 - Farnsworth-Munsell, if available
6. Refraction (50)
 - Retinoscopy – Streak/Priestley Smith
 - Use of Jackson's cross-cylinder
 - Subjective and objective refraction
 - Prescription of glasses
7. Diagnosis and assessment of squint
 - Ocular position and motility examination (25)
 - Synoptophore usage
 - Hess/Lees screen usage (25)
 - Diplopia charting (25)
 - Assessment of strabismus – Cover tests/prisms bars
 - Amblyopia diagnosis and treatment
 - Assessment of convergence, accommodation, stereopsis, suppression
8. Exophthalmometry
 - Usage of Hertel exophthalmometer – Proptosis measurement
9. Contact lenses (CL)
 - Fitting and assessment of rigid gas permeable and soft lenses
 - Subjective verification of over-refraction
 - Complications arising of CL use
 - Educating the patient regarding CL usage and imparting relevant knowledge of the complications arising thereon
10. Low-vision aids
 - Knowledge of basic optical devices available and relative advantages and disadvantages of each
 - The basics of fitting with knowledge of availability and cost.

The resident must be well versed with the following investigative modalities although he/she may or may not perform it himself/herself. However, he/she should be able to interpret the following tests:

1. Fundus photography
2. Fluorescein angiography
3. Ophthalmic ultrasound A-scan/B-scan
4. Automated perimetry for glaucoma and neurological lesions
5. Radiological tests
 - X-rays – Anteroposterior/lateral view
 - Paranasal sinus (Water's view)/optic canal views
 - Localization of intraocular and intraorbital foreign bodies (FBs)
 - Interpretations of ultrasonography (USG)/computed tomography (CT)/magnetic resonance imaging (MRI) scans
6. Optical coherence tomography (OCT) and ultrasound biomicroscopy
7. Electroretinogram, electrooculogram, and visual-evoked potential
8. Corneal topography.

Minor surgical procedures – Must know and perform independently

- Conjunctival and corneal FB removal on the slit lamp
- Chalazion incision and curettage
- Pterygium excision
- Biopsy of small lid tumors
- Suture removal – Skin/conjunctival/corneal/corneoscleral
- Tarsorrhaphy
- Subconjunctival injection
- Retrobulbar, parabolbar anesthesia
- Posterior subtenon's injections
- Artificial eye fitting
- Acute management of acid and alkali burns.

Surgical procedures

1. Must know and can perform independently
 - a. Ocular anesthesia:
 - Retrobulbar anesthesia
 - Peribulbar anesthesia
 - Facial blocks – O'Brien/Atkinson/Van Lint and modifications
 - Frontal blocks
 - Infraorbital blocks
 - Blocks for sac surgery
2. Must be able to independently perform and deal with complications arising from the following surgeries:
 - a. Lid surgery
 - Tarsorrhaphy
 - Ectropion and entropion
 - Lid repair following trauma
 - Epilation
 - b. Destructive procedures
 - Evisceration with or without implant
 - Enucleation with or without implant
 - c. Sac surgery
 - Dacryocystectomy
 - Dacryocystorhinostomy
 - Probing for congenital obstruction of nasolacrimal duct
 - d. Strabismus surgery
 - Recession and resection procedures on the horizontal recti

- e. Orbit surgery
 - Incision and drainage via anterior orbitotomy for abscess
- f. Cyclocryotherapy/cyclophotocoagulation
3. Residents should be well conversant with the use of an operating microscope and must be able to perform the surgeries listed below competently under the same:
 - a. Cataract surgery
 - Standard extracapsular cataract extraction (ECCE) with or without intraocular lens (IOL) implantation
 - Small incision ECCE with or without IOL implantation and/or phacoemulsification with posterior-chamber (PC) IOL implantation
 - Secondary AC or PC IOL implantation
 - b. Vitrectomy/scleral buckling
 - Intravitreal and intracameral (AC) injection techniques and doses of drugs for the same
 - Need to know the basis of vitrectomy (anterior segment) as well as management of cataract surgery complications
 - Assist vitrectomy and scleral buckling procedures
 - c. Ocular surface procedures
 - Pterygium excision with modifications
 - Conjunctival cyst excision/FB removal
 - Corneal FB removal
 - Conjunctival flap/peritomy
 - d. Glaucoma – Trabeculectomy
 - e. Corneal
 - Repair of corneoscleral perforations
 - Corneal suture removal
 - Application of glue and bandage CL
4. Should have performed/assisted the following microscopic surgeries:
 - a. Keratoplasty
 - Therapeutic and optical
 - b. Glaucoma surgery
 - Pharmacological modulation of trabeculectomy
 - Trabeculotomy
 - Goniotomy
 - Glaucoma valve implant surgery
5. Desirable to be able to perform following laser procedures:
 - a. YAG capsulotomy
 - b. Laser iridotomy
 - c. Focal and panretinal photocoagulation
6. Should have assisted/knowledge of keratorefractive procedures.

Operations

The resident is provided with an opportunity to perform operations both extraocular and intraocular with the assistance of the senior residents and/or under the direct supervision of a faculty member. He/she is provided with an opportunity to learn special and complicated operations by wet laboratory training, to assist the senior resident or the faculty in operations of cases of the specialty, and to be responsible for the postoperative care of these cases.

It is essential that resident should perform at least 50 cataract surgeries, five glaucoma surgeries, five squint surgeries, five eyelid surgeries (entropion/ectropion/eyelid repair), five sac surgeries, and five eye retrieval procedures by the completion of the term.

A phased program may be chalked out. In the first phase, the resident is given training in the preparations of cases for operation, premedication, and regional anesthetic blocks. In the next phase, the resident assists the operating surgeon during the operations. In the third phase, the resident operates independently assisted by a senior resident or a faculty member. He/she is required to be proficient in some operations and shows familiarity with others.

Instructional Strategy: Teaching and Learning Methods

Theoretical teaching

The theoretical knowledge is imparted to the candidate through distinct courses of lecture demonstrations, seminars, symposia, and inter- and intra-departmental meetings. The students are exposed to recent advances through discussions in journal clubs and participation in Continuing medical education (CME) programmes and symposia.

Knowledge in applied, basic, paraclinical, and clinical sciences may be imparted by the members of the staff in respective disciplines or by clinicians themselves by conducting didactic courses (lectures and demonstrations).

The residents are imparted clinical training in several ways:

1. Group discussion: The junior residents may present the symposium to their senior PGs where it is fully discussed before finally being discussed in front of the faculty or senior eye specialists. A free and fair discussion is encouraged. These discussions enable the residents to prepare for a general discussion in the class
2. Clinical case discussion
 - a. Bedside discussion on the rounds and outpatient teaching take their toll with patient management. Therefore, in addition to these, clinical case discussions should form part of a department's schedule at a fixed time every week. This could range from 1 to 2 hours (h) and could be held at least once a week. The choice and manner of presentation and discussion vary widely and are left to the discretion of the department. Every effort should be made to include as wide a variety of cases as possible over 3 years with multiple repetitions. Problem-oriented approach is better as it aids in decision-making skills
 - b. In addition to bedside teaching rounds, at least 5 hours (h) of formal teaching per week is necessary
 - c. Consultant case presentation is another approach which should be encouraged as it aids in solving complex problems and also is a forum for discussion of interesting cases
 - d. Case discussions on the patient's records written by the student are to be encouraged as it helps exercise the student's diagnostic and decision-making skills. It also helps the consultant in critical evaluation of the student's progress academically
 - e. Case presentation at other in-hospital multidisciplinary forums
3. Seminars: Seminars should be conducted at least once weekly. The duration should be at least 1 hour. The topics selected should be repeated once in 3 years so as to cover as wide a range of topics as possible. Seminars could be individual presentations or a continuum (large topic) with many residents participating.
4. Journal clubs: Journals are reviewed in particular covering

all articles in that subject over a 6-month period and are discussed by the resident under the following headings:

- a. Aim
 - b. Methods
 - c. Observations
 - d. Discussions
 - e. Conclusions
- The resident to whom the journal is allotted presents the journal summaries to the senior PGs. They are expected to show their understanding of the aspects covered in the article and clarify any of the points raised in the article, offer criticisms, and evaluate the article in the light of known literature
5. Outpatients: For the first 6 months of the training program, residents may be attached to a faculty member to be able to pick up methods of history taking and ocular examination in ophthalmic practice. During this period, the resident may also be oriented to the common ophthalmic problems. After 6 months, the clinical resident may work independently, where he/she receives new and old cases including refractions and prescribes for them. The residents are attached to a senior resident and a faculty member whom they can consult in case of difficulty
 6. Wards: Each resident may be allotted beds in the inpatient section depending upon the total bed capacity and the number of the PGs. The whole concept is to provide the resident increasing opportunity to work with increasing responsibility according to their seniority. Detailed history and case records are to be maintained by the resident. Relevance of beds and admissions in ophthalmology has really gone down as most of the surgical and special investigative procedures are being performed on an outpatient basis. Most of the teaching has to be imparted in outpatients department and special clinics
 7. Specialty clinics: The student must rotate in the following subspecialty clinics:
 - a. Anterior segment and cataract
 - b. Glaucoma
 - c. Oculoplastics, lacrimal and orbit
 - d. Pediatric ophthalmology and strabismus
 - e. Retina and uvea
 - f. Cornea, CL, and low vision
 - g. Neuro-ophthalmology
 8. Practicals in ocular histopathology/ocular microbiology: The residents may be provided with fully stained slides of the ocular tissues and of microbiological specimens along with relevant clinical data and discuss the diagnosis and differential diagnosis on the basis of the information provided
 9. Attend accredited scientific meetings (CME, symposia, and conferences)
 10. Additional sessions on basic sciences, biostatistics, research methodology, teaching methodology, hospital waste management, health economics, and medical ethics and legal issues related to ophthalmology practice are suggested
 11. Active involvement in undergraduate teaching
 12. Maintenance of logbook.

Recommended Reading

General references

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Useful organization websites

1. American Academy of Ophthalmology (AAO): <https://www.aao.org> and the AAO's Education Resource Center: <https://www.aao.org/education/index.cfm>
2. American Board of Ophthalmology: <https://www.abop.org>
3. Digital Journal of Ophthalmology: <http://www.djo.harvard.edu>
4. Eye Search: <https://www.eyesearch.com>
5. Eye Atlas-Online Atlas of Ophthalmology: <http://www.eyeatlas.com>
6. Eye Cancer Network: <https://eyecancer.com>
7. Eye Library.Org: <http://www.eyelibrary.org>
8. Eye Text.Net: <http://www.eyetext.net>
9. Accreditation Council for Graduate Medical Education: <http://www.acgme.org>
10. Images of Eye Diseases: <https://www.redatlas.org>
11. ICO: <http://www.icoph.org> (has links for Basic and Clinical Assessments, i.e., testing and examinations; e-mail address: assess@icoph.org)
12. Ophthalmic resource searches (i.e., search for "eye resources on the Internet" or search by ophthalmic keywords): <http://www.google.com>
13. New York Eye and Ear Infirmary: Digital Atlas of Ophthalmology: http://www.nyee.edu/page_deliv.html?page_no=50
14. Royal College of Ophthalmologists: <http://www.rcophth.ac.uk>
15. Royal Australian and New Zealand College of Ophthalmology: <http://www.ranzco.edu>
16. Wilmer Ophthalmological Institute: <http://www.wilmereyelinstitute.net>

Selected ophthalmology journal websites

1. Acta Ophthalmologica Scandinavica: <http://www.blackwellpublishing.com/journals/aos>
2. American Journal of Ophthalmology: <http://www.ajo.com>
3. AAO: <https://www.aao.org>
4. Several subspecialty journals are available through: <http://www.ophsource.org>
5. Archives of Ophthalmology: <http://www.archophthalmol.com>
6. British Journal of Ophthalmology: <http://bio.bmi.com> [Last accessed on 2018 May 01].
7. Canadian Journal of Ophthalmology: <https://www.canadianjournalofophthalmology.ca> [Last accessed on 2018 May 01].
8. Clinical and Experimental Ophthalmology: <https://onlinelibrary.wiley.com/journal> [Last accessed on 2018 May 01].

9. Current Opinion in Ophthalmology: <http://www.co-ophthalmology.com>
10. European Journal of Ophthalmology: <http://www.eur-j-ophthalmol.com/ejo>
11. Eye: <http://www.nature.com/eye>
12. Graefe's Archive for Clinical and Experimental Ophthalmology: <http://www.springerlink.com>
13. Indian Journal of Ophthalmology (IJO): <http://www.ijo.in>
14. International Ophthalmology Clinics: <http://www.internat-ophthalmology.com>
15. Investigative Ophthalmology and Visual Science: <http://www.iovs.org>
16. Japanese Journal of Ophthalmology: <http://www.springerlink.com>
17. Ophthalmologica: <http://www.karger.com>
18. Transactions of the American Ophthalmological Society: <http://www.aosonline.org>
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Books

1. Albert DM, Jakobiec FA. Principles and Practice of Ophthalmology. 2nd ed. Philadelphia: W.B. Saunders Co.; 2000.
2. Duke-Elder S. System of Ophthalmology. St. Louis: Mosby; 1941-1972.
3. Easty DL, Sparrow JM. Oxford Textbook of Ophthalmology. Vol. 2. Oxford, New York: Oxford University Press; 1999.
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14. Milder B, Rubin ML. The Fine Art of Prescribing Glasses without Making a Spectacle of Yourself. 2nd ed. Gainesville: Triad Publishing Co.; 1991.
15. Rhee DJ, Pyfer MF. The Wills Eye Manual: Office and Emergency Room Diagnosis and Treatment of Eye Disease. 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 1999.
16. Spalton DJ. Atlas Oftalmologia Clinica. 2nd ed. Madrid: Mosby/Doyma Libros; 1995.
17. Varma R. Essentials of Eye Care: The Johns Hopkins Wilmer Handbook. Philadelphia: Lippincott-Raven; 1997.
18. Wilson FM, Blomquist PH. Practical Ophthalmology: A Manual for Beginning Residents. 5th ed. San Francisco: American Academy of Ophthalmology; 2005.
19. Tong-ho Y, Sang-uk Y, Ch'oe OK. Angwahak (Ophthalmology). 6th ed. Seoul, Korean: Ilchogak; 2002.

Assessment

Formative assessment, i.e., during the training

Internal assessment (75 marks)

- Personal attributes: Ongoing after each clinical posting
- Clinical skills and performance: Ongoing after each clinical posting
- Academic activities: Ongoing after each clinical posting
- Theory assessment: End of 1 year and 2 years and at 2-year 9 months
- Practical assessment: Ongoing after each clinical posting

Clinical skills, academic performance, and personal attributes shall be graded on a scale of 1-5 (5 being the highest). The academic presentations shall be graded at the time of presentation by the consultant in-charge. Evaluation on clinical skills and personal attributes and others shall be done by the unit in-charge at the end of every semester.

Surgical skills are to be assessed on the basis of surgical competency-based rubric [example for ECCE is enclosed in Annexure 2].

The departments may select a mix of the following sessions and award grade for each resident:

- Journal club: Once a week
- Seminar, lecture: Once a week
- Case presentations: Twice a week
- Interdepartmental case or seminar: Once a week.

The format for assessment of academic exercises is enclosed in Annexure 3.

End assessment, i.e., assessment at the end of training

Logbook (25 marks)

It is maintained to monitor the investigative and surgical procedures. It should include follow-up of the resident's surgical cases (minimum numbers as listed earlier) till the final visit. It should also include the visits to the PHC and school screening.

Postgraduate examination

The PG examination shall be in three parts.

Thesis/dissertation

Topic of thesis/dissertation should be decided by the student in consultation with the teacher. Thesis is to be submitted by each candidate at least 6 months before the date of commencement of the theory examination. The thesis shall be examined by a minimum of three examiners, one internal and two external examiners, who shall not be the examiners for theory and practical. On the acceptance of the thesis by two examiners, the candidate shall appear for the final examination.

Theory

There shall be four theory papers.

- Paper I: Basic sciences including biostatistics and research methodology related to Ophthalmology
- Paper II: Clinical ophthalmology
- Paper III: Principles and practice of surgery of eye and related topics
- Paper IV: Recent advances and community ophthalmology.

Practicals

Clinical (200 marks)

- One long case (60)
- Two short cases with different problems (40)/two spot cases (20)
- Two fundus cases (40)
- One refraction case (10)
- One OCEX case (30) [details enclosed in Annexure 4].

Viva voce (100 marks)

This may be conducted as objectively structured clinical evaluation (OSCE) whenever feasible [format in Annexure 5]:

1. Instruments
2. Pathology, microbiology specimens
3. Drugs, X-rays, USG/OCT/CT/MRI scans, etc.
4. Visual fields and other ophthalmic diagnostic charts.

Infrastructure Requirements and Faculty

Equipment

1. Slit lamps with applanation tonometer (1 for every 2 students), observer tube/photo attachment (at least in one slit lamp)
2. Direct and indirect ophthalmoscope
3. 90-D, 78-D lens, and gonioscope
4. Retinoscope
5. Visual field analyzer
6. Fundus fluorescein angiography (FFA)
7. Optical Coherence Tomography (OCT)
8. Lasers – YAG, diode/double frequency
9. A and B USG
10. Keratometer/autorefractometer
11. Synoptophore
12. Hess/ Lees' chart
13. Red/green spectacles
14. Hertel exophthalmometer
15. Operating microscope with a side viewing piece or a camera
16. Phaco machine
17. Vitrectomy machine
18. Color vision charts
19. Pediatric vision tools
20. Essential anesthesia and resuscitation equipment
21. Basic wet laboratory facilities with operating microscope (may be shared with other faculties).

Teaching

1. Library with at least two international and two Indian journals
2. Internet with OVID
3. Computer, LCD projector.

Bed Strength and Patient Volume Requirements

For ophthalmology, the bed strength requirement should be flexible. The main criterion should be number of surgical procedures being performed (over 500 major surgeries/year), outpatient attendance (over 12,000 per year), availability of subspecialty services, and availability of adequate infrastructure.

Faculty Requirement

- One professor/associate professor, one junior faculty, and one senior resident (registrar) for one seat/year.

We hope that this effort would help provide a basis for the development of curricula to the institutions imparting residency training. The fact that the curriculum is a dynamic document requiring constant updating and adaptation according to the local requirements cannot be overemphasized.

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Annexures

Annexure 1

Outlines the course content in subspecialties. It may be accessed on the IJO website : [http://www.icoph.org/refocusing_education/curricula, html](http://www.icoph.org/refocusing_education/curricula.html)

Annexure 2

Documents the OSCAR for ECCE adapted from ICO rubric as an example (ICO-OSCAR: ECCE).

Rating scale for Annexure 2 is as follows:

- 1 - Poor
- 2 - Average
- 3 - Good

- Peribulbar block
- Draping
- Microscope handling
- Bridle suture
- Scleral access and cauterization
- Viscoelastic: Appropriate use and safe insertion
- Anterior capsulotomy
- Wound enlargement
- Nucleus hydrodissection
- Nucleus extraction
- Irrigation and aspiration technique with adequate removal of cortex
- Lens insertion, rotation, and final position of IOL
- Wound closure: Suture handling and placement
- Wound closure: Suture tying and knot rotation
- Wound closure: Viscoelastic removal, wound hydration, and wound security
- Overall speed and fluidity of procedure

Annexure 3

Is an adapted and simplified rubric for assessment of presentations by the residents.

Rating scale for Annexure 3 is as follows:

- 0 - Poor
- 1 - Average
- 2 - Good

- Presentation
- Body language
- Voice
- Quality of slides
- Confidence
- Clarity
- Subject content
 - Basics
 - Definition
 - Relevance
 - Advances
 - References
- Discussion and question-answers

Annexure 4

Is an adapted rubric for an OCEX – Total marks – 30.

Rating scale for Annexure 4 is as follows:

- 0 - Poor
- 1 - Average
- 2 - Good

History taking (maximum score of 7)

- Obtained chief complaint
- History of present illness
- Pertinent negatives
- Pain inquiry
- Allergies
- Medical history
- Relevant family and social history

Examination (maximum score of 7)

- Best-corrected visual acuity
- Hirschberg's test
- Motility/proptosis
- Pupils/ Relative afferent pupillary defect
- Slit-lamp examination (gonioscopy)
- Intraocular pressure
- Fundoscopy

Professionalism (maximum score of 6)

- Respectful and courteous
- Used language the patient understands
- Explained findings
- Explained diagnosis/prognosis
- Explained plan/options
- Answered patient's questions

Case presentation (maximum score of 10)

- Concise and clear
- Pertinent facts
- Appropriate differential diagnosis
- Appropriate plan
- Response to examiner's questions.

Annexure 5

Presents outline for the structure of an OSCE.

There are 10 stations (each station carries 10 marks). Total marks – 100.

Stations comprise:

1. Instrument
2. Clinical picture (anterior or posterior segment)
3. CT/MRI/X-ray
4. Histopathology/microbiology
5. Viva voce
6. Charts – Diplopia/fields
7. Case scenario
8. Ocular imaging – OCT/FFA/USG
9. Refraction
10. Ocular pharmacology

Annexure 1:

Course Content

The course content has been classified into basic-level goals (postgraduate year [PGY] 1), standard-level goals (PGY 2), and advanced level goals (PGY 3). Some of the goals in advanced level are aspirational and may be modified as per the needs of the program or taken as reflecting the goals of a subspecialty training program in the concerned subject.

Disorders of the Lids, Lacrimal System, and Orbit

Basic-level goals (Postgraduate year 1)

Cognitive skills

1. Describe basic eyelid, lacrimal, and orbital anatomy and physiology (e.g., eyelid, orbicularis, orbital structures, meibomian glands, lacrimal glands, Zeis glands, Whitnall's ligament, Muller's muscle, Lockwood's ligament, canaliculi, puncta, orbital bones, orbital foramina, paranasal sinuses, annulus of Zinn, arterial and venous vascular supply, lymphatics, nerves, extraocular muscles)
2. Describe basic mechanisms of and indications for treatment of eyelid, orbital, and lacrimal trauma
3. Describe epidemiology, clinical features, evaluation, and management of fetal alcohol syndrome
4. Perform preoperative and postoperative assessment of patients with common oculoplastic disorders
5. Recognize simple orbital trauma (e.g., orbital foreign body [FB], retrobulbar hemorrhage)
6. Recognize and treat floppy eyelid syndrome
7. Recognize and treat localized trichiasis
8. Recognize blepharospasm and hemifacial spasm
9. Describe the differential diagnosis of common orbital tumors in children and adults
10. Describe the differential diagnosis of lacrimal gland mass (e.g., inflammatory, neoplastic, congenital, infectious)
11. Identify normal orbital anatomy on imaging studies (e.g., magnetic resonance imaging [MRI], computed tomography [CT], ultrasound)
12. Describe the differential diagnosis of proptosis in children and adults
13. Describe techniques and complications of minor operating room procedures (e.g., incision and drainage of chalazia, excision of small eyelid lesions)
14. Describe typical features of orbital cellulitis.

Technical/surgical skills

1. Describe indications for and perform the basic office examination techniques for the most common oculoplastic and orbital abnormalities
2. Perform the basic assessment of the eyelids, eyebrows, and eyelashes (e.g., eversion, double eversion, margin to reflex distance, lid crease, levator function, eyelid/brow malpositions)
3. Identify indications for and perform the basic lacrimal assessment (e.g., dye testing, punctal dilation, canalicular probing, lacrimal irrigation)
4. Identify indications for and perform the basic assessment of the orbit (e.g., Hertel exophthalmometry, inspection, palpation, auscultation)

5. Identify indications for and perform the basic socket assessment (e.g., types of implants, socket health)
6. Perform minor lid and conjunctival procedures (e.g., removal of benign eyelid skin lesions, chalazion curettage or excision, conjunctival biopsy)
7. Treat complications of minor operating room procedures (e.g., incision and drainage of chalazia, excision of small eyelid lesions)
8. Perform punctal plug insertion or removal
9. Recognize and treat trichiasis (e.g., epilation, cryotherapy, surgical therapy)
10. Perform a simple enucleation or evisceration under supervision.

Standard-level goals: Postgraduate year 2

Cognitive skills

1. Describe more advanced eyelid, lacrimal, and orbital anatomy and physiology (e.g., lacrimal apparatus, orbital vascular anatomy)
2. Describe the genetics (where known), clinical features, evaluation, and treatment of congenital eyelid deformities (e.g., coloboma, distichiasis, epicanthus, telecanthus, blepharophimosis, ankyloblepharon, epiblepharon, euryblepharon, and Goldenhar syndrome, Treacher–Collins syndrome, Waardenburg syndromes)
3. Describe the clinical features, evaluation, and management of congenital orbital deformities (e.g., synophthalmia, anophthalmia, microphthalmia, cryptophthalmos, hypertelorism, hypotelorism)
4. Describe the genetics, clinical features, evaluation, and management of common craniosynostoses and other congenital malformations (e.g., Crouzon and Apert syndromes)
5. Treat (or refer for treatment) congenital eyelid abnormalities (see basic level, above)
6. Perform preoperative and postoperative assessment of patients with simple and more serious oculoplastic disorders (e.g., multidisciplinary procedures)
7. Describe the mechanisms and indications for the treatment of more advanced eyelid, orbital, and lacrimal trauma (e.g., full-thickness lid laceration, chemical burns to the face)
8. Describe features of, evaluate, and treat, more complicated cases of nasolacrimal duct obstruction, canaliculitis, dacryocystitis, acute and chronic dacryoadenitis, preseptal cellulitis, and orbital cellulitis
9. Recognize, evaluate, and treat thyroid ophthalmopathy (e.g., epidemiology, symptoms and signs, associated systemic diseases, orbital imaging, differential diagnosis, surgical, medical, and radiation indications, and side effects of treatment)
10. Recognize, evaluate, and treat orbital inflammatory pseudotumor (e.g., symptoms and signs, orbital imaging, differential diagnosis, biopsy indications, choice of treatments)
11. Recognize, treat, or refer blepharospasm or hemifacial spasm
12. Recognize less common orbital tumors (e.g., metastatic lesions).

Technical/surgical skills

1. Describe indications for and perform more advanced examination techniques for less common oculoplastic and orbital abnormalities (e.g., measurement of levator function, orbital ultrasound interpretation)

2. Identify indications for and perform more advanced assessment of eyelids and eyebrows (e.g., hypoglobus, facial asymmetry, brow ptosis)
 3. Identify indications for and perform more advanced lacrimal assessment (e.g., interpretation of dye testing, canalicular probing in trauma)
 4. Identify indications for and perform more advanced assessment of the orbit (e.g., enophthalmos, interpretation of orbital ultrasound in common conditions)
 5. Identify indications for and perform more advanced socket assessment (e.g., extrusion of implants, anophthalmic socket complications)
 6. Perform more complicated minor lid procedures (e.g., larger benign skin lesions) or surgery (e.g., recurrent or multiple chalazion)
 7. Recognize the indications and complications and perform more complex minor operating room or limited operating room procedures (e.g., incision and drainage of recurrent or larger chalazia, excision of moderate-sized benign eyelid lesions)
 8. Recognize and treat orbital trauma (e.g., intraorbital FB, retrobulbar hemorrhage, fracture)
 9. Identify common orbital pathology (e.g., orbital fractures, orbital tumors) on imaging studies (e.g., MRI, CT, ultrasound)
 10. Treat common presentations of preseptal or orbital cellulitis
 11. Describe and recognize the indications for and complications of and perform the basic lacrimal procedures below:
 - a. Lacrimal drainage testing (irrigation, dye disappearance test)
 - b. Lacrimal intubation
 - c. Dacryocystorhinostomy (external)
- g. Facial dystonia (e.g., blepharospasm, hemifacial spasm)
 - h. Facial nerve palsy with exposure keratopathy (e.g., tarsorrhaphy, gold weights)
 - i. Complex lid and orbital trauma cases.

Technical/surgical skills

Advanced-level goals: Postgraduate year 3

Cognitive skills

1. Describe the most advanced eyelid, lacrimal, and orbital anatomy and physiology
 2. Evaluate and treat simple and more advanced eyelid, orbital, and lacrimal trauma (e.g., full-thickness lid laceration, chemical burns to the face)
 3. Perform preoperative and postoperative assessment and coordination of care of patients with more advanced or complex oculoplastic disorders (e.g., systemically ill patients, multidisciplinary procedures)
 4. Describe the etiology, evaluation, and medical and surgical treatment of the following eyelid diseases:
 - a. Complex ectropion (e.g., congenital, paralytic, involutional, cicatricial, mechanical, allergic)
 - b. Complex entropion (e.g., involutional, cicatricial, spastic, congenital)
 - c. Complex myogenic ptosis (e.g., chronic progressive external ophthalmoplegia)
 - d. Complex differential diagnosis for dermatochalasis (e.g., blepharochalasis)
 - e. Benign, premalignant, or malignant eyelid tumors (e.g., papilloma, keratoacanthoma, seborrheic keratosis, epidermal inclusion cyst, molluscum contagiosum, verruca vulgaris, actinic keratosis, basal cell carcinoma, squamous cell carcinoma, sebaceous cell carcinoma, melanoma)
 - f. Single or recurrent inflammatory lesions (e.g., recurrent chalazion or its mimics)
1. Describe the indications for and perform more complicated and advanced "in-office" examination techniques for less common, but important oculoplastic and orbital abnormalities
 2. Perform preoperative and intraoperative assessment of the eyelids and eyebrows (e.g., intraoperative adjustments)
 3. Recognize and treat more complex or difficult socket-related problems and complications (e.g., extrusion of implants, anophthalmic socket complications)
 4. Perform more complicated lid procedures (e.g., larger benign, recurrent, or multiple skin lesions)
 5. Perform more advanced lacrimal assessment (e.g., intraoperative and postoperative testing, more complex trauma to lacrimal system)
 6. Describe management of and treat lacrimal system abnormalities including:
 - a. More complex congenital disorders (e.g., canalicular stenosis)
 - b. More complex acquired disorders and their treatment (e.g., conjunctivodacryocystorhinostomy with Jones tube)
 - c. Complex moderate trauma (e.g., requiring lacrimal intubation)
 7. Recognize typical and atypical features and describe the differential diagnosis, clinical features, and treatment of more complicated orbital diseases including:
 - a. More complex orbital infections (e.g., preseptal and orbital cellulitis, mucormycosis, aspergillosis)
 - b. Congenital tumors (e.g., dermoid)
 - c. Fibro-osseous disorders and tumors (e.g., fibrous dysplasia, osteoma, chondrosarcoma, osteosarcoma, Paget's disease)
 - d. Vascular tumors (e.g., capillary hemangioma, cavernous hemangioma, hemangiopericytoma, lymphangioma, Kaposi's sarcoma)
 - e. Xanthomatous tumors (e.g., xanthelasma, juvenile xanthogranuloma)
 - f. Lacrimal gland tumors (e.g., benign mixed tumor, adenoid cystic carcinoma, malignant mixed tumor, lymphoma)
 - g. Neural tumors (e.g., optic nerve glioma/meningioma, neurofibromatosis, neuroblastoma)
 - h. Rhabdomyosarcoma
 - i. Orbital pseudotumor
 - j. Lymphoid lesions (e.g., lymphoid hyperplasia, lymphoma, leukemia)
 - k. Thyroid-related orbitopathy
 - l. Metastatic tumors (e.g., from breast, lung, prostate, colon, melanoma)
 - m. Trauma (e.g., orbital fractures, traumatic optic neuropathy)
 - n. Anophthalmic socket-implant exposure, volume augmentation
 8. Describe and recognize the indications for and complications of and perform the eyelid procedures listed below
 - a. Basic biopsy techniques
 - b. Lateral tarsal strip

- c. Specialized lid suture procedures (e.g., Quickert sutures)
 - d. Medial spindle
 - e. Retractor reinsertion
 - f. Levator advancement
 - g. Eyelid laceration/margin repair
 - h. Tarsorrhaphy
 - i. Lateral canthoplasty (canthotomy and cantholysis)
 - j. Blepharoplasty
 - k. Facial nerve palsy – Gold weight placement in the lid
 - l. Simple eyelid reconstruction
 - m. Orbital approaches and incisions (e.g., Kronlein, Caldwell-Luc, transconjunctival, transnasal)
9. Describe and recognize the indications for and complications of and perform basic orbital skills and procedures including:
 - a. Anterior orbitotomy for tumor biopsy/excision
 - b. Orbital floor fracture repair
 10. Describe the indications for and interpret CT and MRI scans (e.g., orbital trauma, orbital lesions and tumors)
 11. Perform botulinum toxin injections (e.g., blepharospasm)
 12. Identify more advanced orbital pathology (e.g., complex orbital fractures, orbital tumors) on imaging studies (e.g., MRI, CT, ultrasound).

Disorders of the Cornea, External Diseases, and Refractive Surgery

Basic-level goals: Postgraduate year 1

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. Describe congenital abnormalities of the cornea, sclera, and globe (e.g., Peter's anomaly, microphthalmos, birth trauma, and buphthalmos)
3. Describe characteristic corneal and conjunctival degenerations (e.g., pterygium, pinguecula, senile plaques of the sclera, keratoconus)
4. Recognize the common corneal dystrophies and degenerations (e.g., map-dot-fingerprint dystrophy, Meesmann dystrophy, Reis-Bucklers dystrophy, Francois syndrome, Schnyder's crystalline dystrophy, congenital hereditary stromal dystrophy, lattice dystrophy, granular dystrophy, macular dystrophy, congenital hereditary endothelial dystrophy, Fuchs' dystrophy, posterior polymorphous dystrophy, Salzmann's degeneration)
5. Recognize the common corneal inflammations and infections (e.g., herpes simplex, herpes zoster, syphilis, interstitial keratitis)
6. Understand the fundamentals of corneal optics and refraction (e.g., keratoconus)
7. Describe the fundamentals of ocular microbiology and recognize corneal and conjunctival inflammations and infections (e.g., staphylococcal hypersensitivity, simple microbial keratitis, trachoma, ophthalmia neonatorum, herpes zoster ophthalmicus, herpes simplex keratitis, and conjunctivitis)
8. Know host defense mechanisms of the ocular surface, Gram staining, and classification of bacteria; Antibiotics: mechanisms of action and spectrum of activity of major classes of antibiotics used in ophthalmology bacterial resistance; Viruses: classification, structure and replication, and laboratory methods of detection; Antiviral agents: mechanisms of action; Fungi: classification, host susceptibility factors, antifungal agents, mechanisms of action, *Toxoplasma*, *Chlamydia*, *Acanthamoeba*, understanding of cornea and conjunctival pathology results, and interpretation of ocular cultures
9. Know eye banking procedures, donor selection, corneal storage
10. Recognize the basic presentations of ocular allergy (e.g., phlyctenules, seasonal hay fever, vernal conjunctivitis, allergic and atopic conjunctivitis, giant papillary conjunctivitis)
11. Recognize and treat lid margin disease (e.g., staphylococcal blepharitis, meibomian gland dysfunction)
12. Describe the features of, diagnose, and treat (or refer) Vitamin A deficiency (e.g., Bitot's spot, dry eye, slowed dark adaptation) and neurotrophic corneal diseases
13. Describe the basic differential diagnosis of acute and chronic conjunctivitis or "red eye" (e.g., scleritis, episcleritis, conjunctivitis, orbital cellulitis, and gonococcal and chlamydial conjunctivitis)
14. Describe the basic mechanisms of traumatic and toxic injury to the anterior segment (e.g., alkali burn, lid laceration, orbital fracture)
15. Understand the mechanisms of ocular immunology and recognize the external manifestations of anterior-segment inflammation (e.g., red eye associated with acute and chronic iritis)
16. Describe the basic principles of ocular pharmacology of anti-infective, anti-inflammatory, and immunomodulating agents (e.g., indications and contraindications for topical corticosteroids, nonsteroidal anti-inflammatory agents, and antibiotics)
17. Recognize corneal lacerations (perforating and nonperforating), pterygia that may require surgery, and corneal and conjunctival FBs
18. Diagnose and treat corneal exposure (e.g., lubrication, temporary tarsorrhaphy)
19. Describe the epidemiology, differential diagnosis, evaluation, and management of common benign and malignant lid lesions, including pigmented lesions of the conjunctiva and lid (e.g., nevi, melanoma, primary-acquired melanosis)
20. Describe the epidemiology, classification, pathology, indications for surgery, and prognosis of common malpositions of the eyelids (e.g., blepharoptosis, trichiasis, distichiasis, essential blepharospasm, entropion, ectropion) and understand their relationship to secondary diseases of the cornea and conjunctiva (e.g., exposure keratopathy)
21. Recognize and describe the treatment for a chemical burn (e.g., types of agents, medical therapy)
22. Recognize and describe the etiologies of hyphema and microhyphema
23. Describe the etiologies and treatment of superficial punctate keratitis (e.g., dry eye, Thygeson's superficial punctate keratopathy), blepharitis, toxicity, ultraviolet photokeratopathy, contact lens [CL] related)
24. Describe the symptoms and signs, testing and evaluation for, and treatment of exposure keratopathy and dry eye (e.g., Schirmer test)
25. Recognize the anterior-segment manifestations of systemic diseases (e.g., Wilson's disease) and pharmacologic side

- effects (e.g., amiodarone vortex keratopathy)
26. Recognize, list the differential diagnosis, and evaluate aniridia and other developmental anterior-segment abnormalities (e.g., Axenfeld–Rieger and Peter’s anomalies and related syndromes)
 27. Recognize and treat pyogenic granuloma.

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 (e.g., fluorescein dye and rose Bengal)
3. Perform simple tests for dry eye (e.g., Schirmer test)
4. Perform punctal occlusion (temporary or permanent) or insert plugs
5. Perform simple corneal sensation testing (e.g., cotton tip swab)
6. Perform tonometry (e.g., applanation, Tonopen, Schiotz, pneumotonometry)
7. Perform techniques of sampling for viral, bacterial, fungal, and protozoal ocular infections (e.g., corneal scraping and appropriate culture techniques)
8. Perform and interpret simple stains of the cornea and conjunctiva (e.g., culture techniques, culture media, Gram stain, Giemsa stain, calcofluor-white, acid fast)
9. Manage corneal epithelial defects (e.g., pressure patching and bandage CLs)
10. Perform removal of a conjunctival or corneal FB (e.g., rust ring)
11. Perform primary pterygium excision
12. Perform an isolated lid laceration repair
13. Perform an isolated corneal laceration repair (e.g., linear laceration not extending to limbus)
14. Perform epilation
15. Perform lateral tarsorrhaphy
16. Incise/drain or remove 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. Treat hyphema and microhyphema (e.g., the complications of increased intraocular pressure and rebleeding).

Standard-level goals: Postgraduate year 2

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, and globe (e.g., hamartomas and choristomas)
3. Describe, recognize, evaluate, and treat peripheral corneal thinning (e.g., inflammatory, degenerative, Dellen related, infectious, immunologic)
4. Recognize common conjunctival neoplasms (e.g., benign, malignant tumors)
5. Recognize and treat less common corneal or conjunctival presentations of degenerations (e.g., inflamed, atypical, or recurrent pterygium, band keratopathy)
6. Describe the epidemiology, differential diagnosis, evaluation, and management of Bitot’s spots
7. Describe the differential diagnosis, evaluation, and management of Thygeson’s superficial punctate keratopathy
8. Understand more complex corneal optics and refraction (e.g., irregular astigmatism)
9. Correlate the concordance of the visual acuity with the density of media opacity (e.g., cataract) and evaluate the etiology of discordance between acuity and findings from examination of the media
10. Describe more complex ocular microbiology and describe the differential diagnosis of more complicated corneal and conjunctival infections (e.g., complex, mixed, or atypical bacterial, fungal, *Acanthamoeba*, viral, or parasitic keratitis)
11. Describe differential diagnosis, evaluation, and treatment of interstitial keratitis (e.g., syphilis, viral diseases, noninfectious, immunologic, inflammation)
12. Describe more complex differential diagnosis of the “red eye” (e.g., autoimmune and inflammatory disorders causing scleritis, episcleritis, conjunctivitis, orbital cellulitis)
13. Describe key features of trachoma, including epidemiology, clinical features and staging, and its complications (e.g., cicatrization), prevention (e.g., facial hygiene), topical and systemic antibiotic treatment (especially in hyperendemic regions), and surgery (e.g., tarsal rotation)
14. Describe more complex mechanisms of traumatic and toxic injury to the anterior segment (e.g., long-term sequelae of acid and alkali burn, complex lid laceration involving the lacrimal system, full-thickness laceration)
15. Describe the differential diagnosis and the external manifestations of more complex anterior-segment inflammation (e.g., acute and chronic iritis with and without systemic disease)
16. Describe the more complex principles of ocular pharmacology of anti-infective, anti-inflammatory, and immunomodulating agents (e.g., use of topical nonsteroidal and steroidal agents, topical cyclosporine)
17. Recognize and treat corneal lacerations (perforating and nonperforating)
18. Recognize and treat large, recurrent, or atypical pterygia that may require surgery
19. Describe and treat corneal and conjunctival FBs
20. Diagnose and treat severe corneal exposure (e.g., lubrication, temporary tarsorrhaphy)
21. Recognize and treat common and uncommon benign and malignant lid lesions
22. Recognize and treat common malpositions of the eyelids (e.g., entropion, ectropion, and ptosis) as they apply to secondary corneal disease
23. Recognize and treat recurrent corneal erosions
24. Recognize and treat FB, animal, and plant substance injuries
25. Recognize and treat more complex hyphemas (e.g., surgical indications)
26. Recognize, evaluate, and treat chronic conjunctivitis (e.g., *Chlamydia*, trachoma, molluscum contagiosum, Parinaud’s oculoglandular syndrome, ocular rosacea)
27. Describe the clinical features, pathology, evaluation, and treatment of ocular cicatricial pemphigoid
28. Recognize, evaluate, and treat the ocular complications of severe diseases, such as chronic exposure keratopathy, contact dermatitis, and Stevens–Johnson syndrome
29. Describe the epidemiology, clinical features, pathology,

evaluation, and treatment of peripheral corneal thinning or ulceration (e.g., Terrien's marginal degeneration, Mooren's ulcer, rheumatoid arthritis-related corneal melt).

Technical/surgical skills

1. Perform more advanced techniques, including keratometry, keratoscopy, endothelial cell count and evaluation, specular microscopy, and pachymetry
2. Perform stromal micropuncture
3. Perform application of corneal glue
4. Assist in more complex corneal surgery (e.g., penetrating keratoplasty and phototherapeutic keratectomy)
5. Perform more advanced tests for dry eye (e.g., modified Schirmer tests, assessment of tear breakup time, fluorescein dye testing, rose Bengal dye)
6. Perform more complex pterygium excision, including conjunctival grafting
7. Perform more complex lid laceration repair
8. Perform manual superficial or lamellar keratectomy
9. Perform more complex corneal laceration repair (e.g., stellate-perforating laceration)
10. Repair simple lacerations of the lacrimal drainage apparatus (e.g., perform intubations and primary closure)
11. Assist lamellar corneal procedures
12. Assist collagen cross-linking.

Advanced-level goals: Postgraduate year 3

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. Describe the most complex and less common congenital abnormalities of the cornea, sclera, and globe (e.g., cornea plana, keratoglobus)
3. Recognize common and uncommon corneal and conjunctival neoplasms, dystrophies, and degenerations (e.g., lattice dystrophy)
4. Understand the most complex corneal optics and refraction (e.g., postkeratoplasty)
5. Describe less common and rare ocular infections and describe the differential diagnosis of the most complicated corneal and conjunctival infections (e.g., amoebas, leishmaniasis, nematodes)
6. In nonendemic areas, describe the basic features of onchocerciasis
7. In endemic areas, define the etiology, vector (e.g., black fly), incidence, diagnostic features (e.g., microfilariae, keratitis, iritis), diagnosis (e.g., skin snip test), course and prognosis, treatment (e.g., ivermectin, nodulectomy), and prevention (e.g., vector control, environmental and behavioral changes) of onchocerciasis
8. Describe the most complex differential diagnosis of the "red eye" (e.g., pemphigoid, pemphigus, Stevens-Johnson syndrome)
9. Diagnose and treat the most complex traumatic and toxic injuries to the anterior segment (e.g., total lid avulsion, severe alkali burn)
10. Describe the differential diagnosis and the external manifestations of the most complex or uncommon anterior-segment inflammations (e.g., syphilitic keratouveitis)
11. Describe the most complex principles of ocular

- pharmacology of anti-infective, anti-inflammatory, and immunomodulating agents (e.g., combination therapies of antiviral and anti-inflammatory agents)
12. Recognize and treat complex corneal lacerations (e.g., lacerations extending beyond the limbus)
 13. Diagnose and treat the most severe corneal exposure cases (e.g., conjunctival flap)
 14. Understand ocular surface transplantation, including conjunctival autograft/flap, amniotic membrane transplantation, and limbal stem cell transplantation
 15. Understand the surgical indications (e.g., Fuchs' dystrophy, aphakic/pseudophakic bullous keratopathy), surgical techniques, and recognition and management of postoperative complications (especially immunologically mediated rejection) of corneal transplantation (e.g., penetrating, lamellar)
 16. Understand the preoperative assessment, patient selection, surgical management, and postoperative care of refractive surgical techniques, including keratotomy (radial, astigmatic), photoablation (photorefractive, phototherapeutic, LASIK), corneal wedge resection, thermokeratoplasty, intracorneal rings, phakic intraocular lens (IOL), and clear lens extraction.

Technical/surgical skills

1. Perform and interpret the most advanced corneal techniques (e.g., pachymetry, endothelial microscopy, computerized corneal topography)
2. Understand and perform specialized and complicated CL fitting (e.g., postkeratoplasty)
3. Perform more complex corneal surgery (e.g., penetrating or lamellar keratoplasty, keratorefractive procedures, and phototherapeutic keratectomy)
4. Repair complex entropion and ectropion
5. Perform a thin conjunctival flap (e.g., Gunderson flap)
6. Perform other complex conjunctival surgery (e.g., autograft, stem cell transplant)
7. Perform basic nonlaser refractive surgery techniques (e.g., relaxing keratotomy)
8. Manage and treat more complex neoplasms of the conjunctiva (e.g., carcinoma, melanoma).

Disorders of the Uveal Tract

Basic-level goals: Postgraduate year 1

Cognitive skills

1. Describe basic principles of history taking and examination of patients with uveitis and related diseases (e.g., scleritis, pemphigus)
2. List signs and symptoms of anterior and posterior uveitis (e.g., red eye, blurred vision, anterior-segment cell and flare, vitreous opacities, pars planitis, retinal or choroidal infiltrates)
3. Describe the different types of uveitis (e.g., acute and chronic uveitis, granulomatous and nongranulomatous uveitis, and anterior, intermediate, and posterior uveitis)
4. Describe typical features and differential diagnosis of anterior uveitis, including infectious (e.g., bacterial, viral, protozoal, parasite), inflammatory (e.g., sarcoid, HLA-B27-associated, Behçet's disease, collagen vascular disease), neoplastic (masquerade syndromes), postsurgical, posttraumatic, Fuchs' heterochromic uveitis, and juvenile rheumatoid arthritis

5. Describe typical features and differential diagnosis of the following posterior-segment uveitis
 - a. Toxoplasmosis
 - b. Sarcoidosis
 - c. Pars planitis
 - d. Acute retinal necrosis
 - e. Vogt-Koyanagi-Harada syndrome
 - f. Large cell lymphoma
 - g. Postoperative uveitis
 - h. Endophthalmitis (e.g., postoperative, traumatic, endogenous, fungal, phacoanaphylactic, sympathetic ophthalmia)
 - i. Unusual infectious etiologies for uveitis (e.g., human immunodeficiency virus, herpes simplex virus, herpes zoster virus, pneumocystis carinii, Lyme disease)
 - j. Acquired and congenital ocular syphilis
 - k. Cytomegalovirus retinitis
 - l. Multiple sclerosis.

Technical/surgical skills

1. Perform an examination of the anterior and posterior segment for uveitis (e.g., slit-lamp biomicroscopy, scleral depression, magnified posterior-segment examination, vitreous evaluation for cells, and retinal, choroidal, and pars plana evaluations)
2. Describe indications for ancillary testing in the evaluation of uveitis (e.g., fluorescein angiography, ultrasound, laboratory testing, and radiologic testing).

Standard-level goals: Postgraduate year 2

Cognitive skills

1. Describe more advanced principles of history taking and examination of patients with uveitis (e.g., review of systems for Wegener's granulomatosis, polyarteritis nodosa, lupus erythematosus, rheumatoid arthritis, inflammatory bowel disease, systemic necrotizing vasculitis; evaluation of skin, cardiac, respiratory, renal, pulmonary, and musculoskeletal systems)
2. List the less common signs and symptoms of anterior and posterior uveitis
3. List differentiating signs of less common forms of uveitis (e.g., iris nodules, conjunctival ulcer, or granuloma)
4. Describe the differential diagnosis of less common forms of uveitis (e.g., chronic uveitis, intermediate uveitis [e.g., pars planitis, and infectious (e.g., Whipple disease, syphilis, or inflammatory posterior uveitis)], masquerade syndromes, including large cell lymphoma)
5. Evaluate and treat common causes of anterior and posterior uveitis.

Technical/surgical skills

1. Perform a directed examination of the anterior and posterior segments for uveitis (e.g., slit-lamp biomicroscopy, scleral depression, magnified posterior-segment examination, vitreous evaluation for cells)
2. Perform ancillary testing in the evaluation of uveitis (e.g., fluorescein angiography, ultrasound, laboratory testing, and radiologic testing).

Advanced-level goals: Postgraduate year 3

Cognitive skills

1. Recognize, evaluate, and treat uveitis associated with immunosuppressed individuals (e.g., active and recovered

acquired immune deficiency syndrome, pharmacologic immunosuppression)

2. Recognize, evaluate, and treat acquired and congenital ocular syphilis
3. Recognize, evaluate, and treat (or refer) less common, rare, or tropical conditions associated with uveitis (e.g., leishmaniasis)
4. Describe indications and contraindications for corticosteroid treatment of uveitis (e.g. topical, local, systemic), including risks and benefits of therapy
5. Describe indications and contraindications for immunosuppressive therapy in uveitis, use of antimetabolites, cyclosporine, and alkylating agents.

Technical/surgical skills

1. Administer steroids in the treatment of uveitis by various routes
2. Administer immunosuppressive agents in uveitis (or refer for administration)
3. Evaluate and treat the complications of uveitis therapy (e.g., cataract, glaucoma)
4. Biopsy, when indicated, the vitreous or uveal tract
5. Insert intravitreal implants containing antiviral or corticosteroid medications
6. Perform, when indicated, vitrectomy or scleral-buckling procedures.

Disorders of the Lens

General educational objectives

1. Describe the evaluation and management of, indications for, intraoperative and postoperative complications of cataract surgery and related anterior-segment procedures
2. Perform the complete preoperative ophthalmologic examination of cataract patients
3. Formulate the differential diagnoses of cataract and evaluate the normal and abnormal lens
4. Perform optimum refraction of the postcataract surgery patient
5. Develop and exercise clinical and ethical decision-making in cataract patients
6. Develop good patient communication techniques regarding cataract surgery
7. Perform routine and advanced cataract surgery and IOL placement
8. Manage basic and advanced clinical and surgical cataract problems
9. Effectively diagnose and manage intraoperative and postoperative complications of cataract surgery
10. Work effectively as a member of the medical care team
11. Develop teaching skills about cataract for instructing junior trainees and students.

Basic-level goals: Postgraduate year 1

Cognitive skills

1. Identify the most common causes and types of cataract (e.g., anterior polar, cortical nuclear sclerotic, posterior subcapsular)
2. List the basic history and examination steps for preoperative cataract evaluation
3. Describe the steps in cataract surgical procedures
4. Define the elementary refraction or CL fitting techniques to obtain best-corrected vision before considering cataract extraction

5. Describe the major etiologies of dislocated or subluxated lens (e.g., trauma, Marfan's syndrome, homocystinuria, Weill–Marchesani syndrome, syphilis)
6. Familiarity with the techniques of intracapsular cataract extraction, extracapsular cataract extraction, small-incision cataract surgery (SICS), and phacoemulsification
7. 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
 - e. Types of IOLs, IOL power calculation
8. Identify and describe the principles and mechanisms of the following instruments in the evaluation of cataract:
 - a. Lensometer
 - b. Autorefractor
 - c. Retinoscope
 - d. Phoropter
 - e. Keratometer
 - f. Slit-lamp biomicroscope
 - g. Glare and contrast testing devices
 - h. Potential acuity meter.
5. Describe the instruments and techniques of cataract extraction, including extracapsular surgery and phacoemulsification (e.g., troubleshooting the phacoemulsification machine, altering the machine parameters)
6. Describe the types, indications, and techniques of anesthesia for cataract surgery (e.g., topical, local, general)
7. Describe indications, techniques, and complications of surgical procedures, including:
 - a. Extracapsular surgery
 - b. SICS
 - c. Intracapsular surgery
 - d. Phacoemulsification
 - e. Paracentesis
 - f. IOL placement
 - g. Femtosecond Laser Assisted Cataract Surgery
8. Describe history and techniques of basic IOL implantation
9. Correlate the level of visual acuity with the lens or capsular opacities
10. Describe the common complications of cataract and anterior segment surgery (e.g., intraocular pressure elevation, hyphema, endophthalmitis, cystoid macular edema, retinal detachment, IOL dislocation, lens-induced glaucoma, and uveitis)
11. Describe the indications for, principles of, and techniques of YAG laser capsulotomy and understand the proper timing of YAG laser capsulotomy.

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 direct and indirect ophthalmoscopy pre- and post-cataract surgery
5. Perform basic steps of cataract surgery (e.g., incision, wound closure) in the practice laboratory
6. Assist at cataract surgery and perform patient preparation, sterile draping, and anesthesia
7. Perform the following steps of cataract surgery in the practice laboratory or under direct supervision, including any or all of the following:
 - a. Wound construction
 - b. Anterior capsulotomy/capsulorhexis
 - c. Instillation and removal of viscoelastics
 - d. Extracapsular, SICS, and phacoemulsification techniques (e.g., sculpting, divide and conquer, phaco chop)
 - e. Irrigation and aspiration
 - f. Cortical cleanup
 - g. IOL implantation (e.g., anterior and posterior).
1. Perform local injections of corticosteroids, antibiotics, and anesthetics
2. Implement the basic preparatory procedures for cataract surgery (e.g., obtaining informed consent, identification of instruments, sterile technique, gloving and gowning, prep and drape, and other preoperative preparation)
3. Use the operating microscope for basic cataract surgery
4. Perform extracapsular surgery and SICS 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. Extracapsular technique
 - e. SICS technique
 - f. Beginning phacoemulsification techniques (e.g., sculpting, divide and conquer, phaco chop)
 - g. Irrigation and aspiration
 - h. Cortical cleanup
 - i. IOL implantation (e.g., anterior and posterior, special IOLs)
5. Perform paracentesis of the anterior chamber (AC)
6. Perform the appropriate steps in cataract surgery, assist in cataract surgery, and perform more advanced steps in patient preparation and anesthesia
7. Describe the more advanced applications of viscoelastics in surgery (e.g., control of iris prolapse, elevation of dropped nucleus, viscodissection, aspiration of residual/retained viscoelastic)
8. Perform basic postoperative evaluation of the cataract patient
9. Recognize and refer or treat common postoperative complications of cataract surgery (e.g., endophthalmitis,

Technical/surgical skills

Standard-level goals: Postgraduate year 2

Cognitive skills

1. Describe the less common causes of lens abnormalities (e.g., spherophakia, lenticonus, and ectopia lentis)
2. Describe the preoperative evaluation of the cataract patient, including:
 - a. The systemic diseases of interest or relevance to cataract surgery
 - b. The relationship of external and corneal diseases of relevance to cataract and cataract surgery (e.g., lid abnormalities, dry eye)
 - c. The relationships of glaucoma, uveitis, and capsular opacities related to cataract surgery
3. Describe glare analysis testing for cataract surgery
4. Describe the use of A-and B-scan ultrasonography (USG) in cataract surgery

elevated intraocular pressure, cystoid macular edema, wound leak, uveitis).

Advanced-level goals: Postgraduate year 3

Cognitive skills

1. Define the more complex indications for cataract surgery (e.g., better view of posterior segment), describe the performance of and the complications of more advanced anterior-segment surgery (e.g., pseudoexfoliation, small pupils, mature cataract, hard nucleus, black cataract, posttraumatic, zonular dehiscence), including more advanced procedures (e.g., secondary IOLs and indications for specialized IOLs, capsular tension rings, iris hooks, use of indocyanine green [ICG] staining of the anterior capsule)
2. Describe the instruments and techniques of cataract extraction, including extracapsular surgery and phacoemulsification (e.g., troubleshooting the phacoemulsification machine, altering the machine parameters)
3. Describe the indications for, techniques of, and complications of cataract extraction in the context of the subspecialty disciplines of glaucoma (e.g., combined cataract and glaucoma procedures, glaucoma in cataractous eyes, cataract surgery in patients with prior glaucoma surgery), retina (e.g., cataract surgery in patients with scleral buckles or prior vitrectomy), cornea (e.g., cataract extraction in patients with corneal opacities), ophthalmic plastic surgery (e.g., ptosis following cataract surgery), and refractive surgery (e.g., cataract surgery in eyes that have undergone refractive surgery)
4. Independently evaluate complications of cataract and IOL implant surgery (e.g., posterior capsular tears, vitreous prolapse, intravitreal dislocation of cataractous fragments, choroidal effusions)
5. Understand indications for and technique of intracapsular surgery (e.g., rare cases may require this procedure or patients may have had the procedure performed previously)
6. Describe indications for and instrumentation and techniques used to implant foldable and nonfoldable IOLs
7. Describe the evaluation and management of common and uncommon causes of postoperative endophthalmitis
8. Perform repositioning, removal, or exchange of IOLs
9. Assist in the teaching and supervision of basic-level and standard-level learners (i.e., first- and second-year residents)
10. Describe the government and hospital regulations that apply to cataract surgery.

Technical/surgical skills

1. Describe the principles of, indications for, mechanics of, and performance of A-scan USG and calculation of IOL power
2. Perform phacoemulsification in a practice setting (e.g., animal or practice laboratory) and then in the operating room, including mastery of the following skills:
 - a. Wound construction
 - b. Anterior capsulotomy/capsulorhexis
 - c. Viscoelastics
 - d. Intracapsular, extracapsular, and phacoemulsification techniques (e.g., sculpting, divide and conquer, phaco chop, stop and chop)
 - e. Instrumentation and techniques of irrigation and aspiration
 - f. IOL implantation (e.g., anterior and posterior, special IOLs)
 - g. IOL repositioning, removal, or exchange.

3. Perform implantation of foldable and nonfoldable IOLs
4. 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. Cystoid macular edema (CME)
 - s. Elevated intraocular pressure and glaucoma
 - t. Postoperative early and late intraocular infection.

Disorders of the Retina

Basic-level goals: Postgraduate year 1

Cognitive skills

1. Describe basic principles of retinal anatomy and physiology (layers of the retina, retinal physiology)
2. Describe fundamentals and demonstrate basic understanding of fluorescein angiography as applied to retinal vascular diseases (e.g., indications, phases of the angiogram)
3. Describe etiologies and mechanisms of retinal detachment
4. Describe macular anatomy, function, and typical features of common macular diseases (e.g., age-related macular degeneration [ARMD], macular hole, macular dystrophies, macular pucker)
5. Describe basic principles of laser photocoagulation
6. Describe and recognize features of commotio retinae, traumatic choroidal rupture, and Purtscher retinopathy
7. Describe common forms of retinal vascular diseases (e.g., branch, hemi-, or central retinal vein and artery occlusion)
8. Describe typical features of retinitis pigmentosa
9. Describe features of, recognize, and evaluate posterior vitreous detachments and retinal detachments.

Technical/surgical skills

1. Perform direct ophthalmoscopy
2. Perform indirect ophthalmoscopy
3. Perform slit-lamp biomicroscopy with the Hruby, +78-D, +90-D lenses, three-mirror CL, or other CLs (e.g., TransEquator)
4. Interpret basic fluorescein angiography in common retinal disorders (e.g., diabetic retinopathy, cystoid macular edema).

Standard-level goals: Postgraduate year 2

Cognitive skills

1. Describe more advanced retinal anatomy and physiology
2. Describe more advanced concepts of fluorescein/ICG

- angiography as applied to retinal vascular and other diseases (e.g., indications, phases of the angiogram)
3. Describe principles of retinal detachment recognition, various types of retinal detachment (e.g., exudative, rhegmatogenous, tractional), and their evaluation, management, and repair (e.g., identify retinal break)
 4. Describe and recognize typical features of less common macular diseases (e.g., parafoveal telangiectasia, cone dystrophies, inherited macular dystrophies, fundus flavimaculatus, toxic maculopathies)
 5. Describe indications for and complications of laser photocoagulation
 6. Describe the findings of major studies in retinal diseases, including the following:
 - a. Diabetic Retinopathy Study (DRS)
 - b. Diabetic Vitrectomy Study (DVS)
 - c. Early Treatment of DRS (ETDRS)
 - d. Macular Photocoagulation Study (MPS)
 - e. Diabetes Control and Complications Trial (DCCT)
 - f. Branch Vein Occlusion Study (BVOS)
 - g. Central Vein Occlusion Study (CVOS)
 - h. United Kingdom Prospective Diabetes Study (UKPDS)
 - i. Age-Related Eye Disease Study
 - j. Verteporfin in Photodynamic Therapy Study (VIP)
 - k. Treatment of ARMD with Photodynamic Therapy Study (TAP)
 7. Describe the fundamentals of, evaluate, and treat (or refer) peripheral retinal diseases and vitreous pathology (e.g., vitreous hemorrhage, retinal breaks)
 8. Describe, evaluate, and treat choroidal detachments, uveal effusion syndrome
 9. Identify and evaluate retinoschisis (e.g., juvenile, senile)
 10. Diagnose, treat, and recognize the complications of retinopathy of prematurity (e.g., retinal detachment)
 11. Diagnose, evaluate, and treat the following retinal vascular diseases:
 - a. Arterial and venous obstructions
 - b. Diabetic retinopathy
 - c. Hypertensive retinopathy
 - d. Peripheral retinal vascular occlusive disease
 - e. Acquired retinal vascular diseases
 - f. Ocular ischemic syndrome
 - g. Sickle cell retinopathy
 - h. Retinal pigment epithelial detachment
 12. Describe and recognize common and uncommon macular disorders
 - a. ARMD
 - b. Choroidal neovascularization (e.g., ARMD, histoplasmosis)
 - c. High myopia
 - d. Macular dystrophies
 - e. Macular pucker (e.g., epiretinal membrane)
 - f. Macular holes
 - g. Cystoid macular edema
 - h. Central serous choroidopathy (retinopathy)
 - i. Optic pit and secondary serous detachment
 - j. Retinal pigment epithelial detachment
 13. Describe the fundamentals of retinal electrophysiology
 14. Describe, recognize, and evaluate hereditary retinal and choroidal diseases (e.g., gyrate atrophy, choroideremia, retinitis pigmentosa, cone dystrophies, Stargardt's disease, Best's disease, congenital stationary night blindness)
 15. Recognize, evaluate, and treat (or refer) retinal and choroidal toxicity (e.g., phenothiazine, hydroxychloroquine/chloroquine toxicity, tamoxifen)
 16. Describe the techniques for retinal detachment repair (e.g., pneumatic retinopexy, scleral buckling, vitrectomy)
 17. Describe the basics of surgical vitrectomy (e.g., indications, mechanics, instruments, and technique)
 18. Describe the indications for and perform basic laser treatment for diabetic retinopathy (e.g., panretinal photocoagulation, macular grid)
 19. Describe the fundamentals of special vitreoretinal techniques
 - a. Macular hole repair
 - b. Epiretinal membrane peeling
 - c. Complex vitrectomy for proliferative vitreoretinopathy
 - d. Use of heavy liquids and intraocular gases (e.g., perfluorocarbons)
 20. Describe, evaluate, and treat posterior uveitis syndromes and endophthalmitis.
- Technical/surgical skills*
1. Perform indirect ophthalmoscopy with scleral indentation
 2. Perform ophthalmoscopic examination with CLs, including panfunduscopy lenses
 3. Interpret fluorescein and ICG angiography
 4. Describe the indications for and interpret retinal imaging technology (e.g., ocular coherence tomography, retinal thickness analysis)
 5. Perform posterior-segment photocoagulation
 6. Perform diabetic focal/grid macular laser treatment
 7. Perform peripheral scatter photocoagulation (panretinal)
 8. Perform laser retinopexy (demarcation) for isolated retinal breaks
 9. Describe the indications for and interpret basic electrophysiological tests (e.g., electroretinogram [ERG], electrooculogram [EOG], visual-evoked potential [VEP], dark adaptation)
 10. Interpret basic ocular imaging techniques (e.g., B-scan echography, nerve fiber layer analysis)
 11. Perform fundus drawings of the retina, showing complex vitreoretinal relationships and findings
 12. Perform cryotherapy of retinal holes and other pathology
 13. Perform scleral buckling
 14. Describe indications, techniques, and complications of pars plana vitrectomy and assist in a retinal surgery or perform the procedure under supervision.
- Advanced-level goals: Postgraduate year 3**
- Cognitive skills*
1. Apply in clinical practice the most advanced knowledge of retinal anatomy and physiology (e.g., surgical anatomy)
 2. Apply in clinical practice the most advanced concepts of fluorescein/ICG angiography in complex retinal vascular and other diseases (e.g., occult choroidal neovascular membranes, recurrent neovascularization, vascular tumors, diseases of choroid and retinal pigment epithelium)
 3. Evaluate, treat, or refer the most complex retinal detachments (e.g., recurrent retinal detachment, proliferative vitreoretinopathy)
 4. Evaluate, treat, or refer the most complex macular disease (e.g., subfoveal or recurrent neovascular membranes)
 5. Describe the indications for laser photocoagulation,

- including photodynamic therapy for the most complex retinal pathology (e.g., subfoveal neovascular membranes)
6. Describe the findings of the major studies in retinal diseases and describe the indications and exceptions for application to individual patients:
 - a. DRS
 - b. DVS
 - c. ETDRS
 - d. MPS
 - e. DCCT
 - f. BVOS
 - g. CVOS
 - h. UKPDS
 - i. TAP (VIP)
 7. Apply in clinical practice understanding of the most complex peripheral retinal diseases and vitreous pathology (e.g., Goldmann–Favre disease, incontinentia pigmenti, familial exudative vitreoretinopathy)
 8. Evaluate and treat complications of retinal photocoagulation (e.g., vitreous hemorrhage, chorioretinal anastomoses)
 9. Recognize and treat complex retinal detachments (e.g., giant tear)
 10. Evaluate, treat, or refer the more complex cases of retinopathy of prematurity (e.g., tractional retinal detachment)
 11. 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
 - e. Acquired retinal vascular diseases
 12. Evaluate and treat or refer the uncommon manifestations or presentations of the following macular diseases:
 - a. ARMD/choroidal neovascularization (e.g., recurrent subfoveal neovascularization)
 - b. Uncommon macular dystrophies
 - c. Refractory cystoid macular edema
 - d. Recurrent central serous choroidopathy (retinopathy)
 - e. Acute posterior multifocal placoid pigment epitheliopathy (choroidopathy)
 - f. Multiple evanescent white dot syndromes
 - g. Serpiginous choroiditis
 - h. Acute zonal outer retinopathy
 - i. Triangular syndrome
 - j. Polypoidal choroidopathy
 13. Apply in clinical practice the more complex retinal electrophysiology (e.g., multifocal electroretinography)
 14. Apply in clinical practice the more complex techniques for retinal detachment repair:
 - a. Repeat scleral buckling
 - b. Pars plana vitrectomy (e.g., diagnostic tap, core vitrectomy, extensive vitrectomy)
 - c. Repair of uveal effusion
 15. Apply in clinical practice the more complex principles of surgical management of diabetic retinopathy (e.g., vitrectomy, membrane release)
 16. Apply in clinical practice complex vitreoretinal techniques:
 - a. Macular hole repair
 - b. Epiretinal membrane peeling
 - c. Complex vitrectomy for proliferative vitreoretinopathy
 - d. Use of heavy liquids
 17. Evaluate, treat, or refer the etiologically more complex or

uncommon cases of posterior uveitis (e.g., sympathetic ophthalmia) and endophthalmitis (e.g., endogenous).

Technical/surgical skills

1. Perform indirect ophthalmoscopy with scleral indentation in complex retinal cases (e.g., multiple holes, documented with detailed retinal drawing)
2. Perform ophthalmoscopic examination with panfunduscopy or other lenses in complex retinal conditions (e.g., giant retinal tears, proliferative vitreoretinopathy)
3. Interpret and apply in clinical practice the results of fluorescein and ICG angiography and optical coherence tomography (OCT) in complex retinal or choroidal pathology (e.g., occult subretinal neovascular membrane)
4. Perform posterior-segment photocoagulation in more complicated retinal cases:
 - a. Diabetic focal/grid macular treatment (e.g., monocular patient, repeat)
 - b. Repeat peripheral scatter photocoagulation (panretinal)
 - c. Laser retinopexy (demarcation) of large or multiple breaks; cryotherapy
5. Interpret and apply in clinical practice electrophysiology (e.g., ERG, EOG, VEP, dark adaptation) in more complicated retinal pathology
6. Interpret and apply in clinical practice ocular imaging techniques (e.g., B-scan echography) in more complex cases (e.g., choroidal osteoma)
7. Perform detailed fundus drawings of the retina with vitreoretinal relationships in the most complex retinal cases (e.g., recurrent retinal detachment, retinoschisis with and without retinal detachment)
8. Perform laser therapy or cryotherapy of retinal holes and other more complex retinal pathology
9. Perform scleral buckling in complex retinal detachment
10. Perform advanced pars plana vitrectomy.

Neuro-ophthalmology

Basic-level goals: Postgraduate year 1

Cognitive skills

1. Describe the neuro-anatomy of the visual pathways
2. Describe the neuro-anatomy of the cranial nerves
3. Describe the pupillary and accommodative neuro-anatomy
4. Describe ocular motility and related neuronal pathways
5. Describe the typical features, evaluation, and management of the most common optic neuropathies (e.g., demyelinating optic neuritis, ischemic optic neuropathy [arteritic and nonarteritic, toxic or nutritional optic neuropathy, Leber's hereditary optic neuropathy, ethambutol toxicity, neuroretinitis, and compressive, inflammatory, infiltrative, and traumatic optic neuropathies])
6. Describe the typical features, evaluation, and management of the most common ocular motor neuropathies (e.g., third, fourth, and sixth nerve palsy)
7. Describe the typical features of cavernous sinus and superior orbital fissure syndromes (e.g., infectious, vascular, neoplastic, inflammatory etiologies)
8. Describe the typical features, evaluation, and management of the most common causes of nystagmus (e.g., congenital motor and sensory, downbeat, upbeat, gaze-evoked, drug-induced)
9. Describe the typical features, evaluation, and management

- of the most common pupillary abnormalities (e.g., relative afferent pupillary defect, anisocoria, Horner's syndrome, third nerve palsy, Adie's tonic pupil)
10. Describe the typical features, evaluation, and management of the most common visual field defects (e.g., optic nerve, optic chiasm, optic radiation, occipital cortex)
 11. Describe the clinical features, evaluation, and management of ocular myasthenia gravis
 12. Describe the clinical features, evaluation, and management of carotid-cavernous fistula
 13. Describe the differential diagnosis, evaluation and management of congenital optic nerve abnormalities (e.g., optic pit, disc coloboma, papillorenal syndrome, morning glory syndrome, tilted disc, optic nerve hypoplasia, myelinated nerve fiber layer, melanocytoma, disc drusen, Bergmeister's papilla).

Technical/surgical skills

1. Perform a basic pupillary examination:
 - a. Describe indications for and perform basic pharmacologic pupillary testing for Horner's syndrome, pharmacologic dilation, and Adie's tonic pupil
 - b. List the differential diagnosis of anisocoria (e.g., sympathetic or parasympathetic lesion, "physiologic" or normal)
 - c. Describe, detect, and quantitate a relative afferent pupillary defect
 - d. List the causes for light-near dissociation (e.g., Argyll-Robertson pupils, diabetic neuropathy, and tonic pupil)
2. Perform a basic ocular motility examination:
 - a. Assess ocular alignment using simple techniques (e.g., Hirschberg test, Krimsky method)
 - b. Describe and perform basic cover/uncover testing for tropia
 - c. Describe and perform alternate cover testing for phoria
 - d. Perform simultaneous prism and cover testing
 - e. Perform measurement of deviations with prisms
 - f. Describe the indications for and apply Fresnel and grind-in prisms
 - g. Describe the indications for and perform forced-duction and forced-generation testing
 - h. Perform an assessment of saccade accuracy and pursuit and optokinetic testing
 - i. Perform a measurement of eyelid function (e.g., levator function, lid position)
3. Describe the indications for visual field testing and perform and interpret perimetry studies:
 - a. Perform confrontational field testing (static and kinetic, central and peripheral, red and white targets)
 - b. Perform and interpret a tangent screen test
 - c. Describe the indications for and perform basic Goldmann perimetry and interpret results
 - d. Describe the indications for and perform basic automated perimetry and interpret results
4. Perform basic direct, indirect, and magnified ophthalmoscopic examination of the optic disc (e.g., recognize optic disc swelling, optic atrophy, neuroretinitis)
5. Describe the anatomy and indications for, order appropriately, and interpret basic radiologic studies of the brain and orbits, demonstrating the ability to communicate with radiologists to maximize both choice of proper diagnostic test and accuracy of interpretation
6. Describe the indications for and interpret basic echography of orbits.

Standard-level goals

Cognitive skills

1. Describe typical and atypical features, evaluation, and management of the most common optic neuropathies (e.g., papilledema, optic neuritis, ischemic, inflammatory, infectious, infiltrative, compressive, and hereditary optic neuropathies)
2. Describe typical and atypical features, evaluation, and management of the more complex supranuclear and internuclear palsies and less common ocular motor neuropathies (e.g., progressive supranuclear palsy and internuclear ophthalmoplegia)
3. Describe typical and atypical features, evaluation, and management of the more complex and less common forms of nystagmus (e.g., rebound, convergence, retraction)
4. Describe typical and atypical features, evaluation, and management of the more complex and less common pupillary abnormalities (e.g., light-near dissociation, pharmacologic miosis)
5. Describe typical and atypical features, evaluation, and management of the more complex and less common visual field defects (e.g., lateral geniculate, monocular temporal crescent)
6. Describe more advanced aspects of visual field indications, selection, and interpretation (e.g., artifacts of automated perimetry, testing and thresholding strategies)
7. Describe neuro-ophthalmic aspects of common systemic diseases (e.g., hypertension, diabetes, thyroid disease, myasthenia gravis, temporal arteritis, systemic infections, and inflammation)
8. Describe neuro-ophthalmologic findings in trauma (e.g., traumatic optic neuropathy, traumatic brain injury)
9. Describe typical features of inherited neuro-ophthalmologic diseases (e.g., Leber's hereditary optic neuropathy, autosomal-dominant optic atrophy, spinocerebellar degenerations)
10. Recognize, evaluate, and treat ocular myasthenia gravis.

Technical skills

1. Describe the indications for, administer, and interpret the results of intravenous edrophonium (Tensilon) and Prostigmin tests for myasthenia gravis
2. Perform a detailed cranial nerve evaluation (e.g., testing of oculomotor, trochlear, trigeminal, and facial nerve function)
3. Describe the more advanced interpretation of neuro-radiologic images (e.g., 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 (e.g., stereopsis, mirror test, red-green testing) of patients with "functional" (nonorganic) visual loss (e.g., recognize nonorganic spiral or tunnel visual fields)
5. Describe the indications for, perform, and list the complications of temporal artery biopsy.

Advanced-level goals

Cognitive skills

1. Describe typical and atypical features, evaluation, and management of the most advanced and least common optic

neuropathies (e.g., chronic or recurrent optic neuritis and posterior ischemic, autoimmune, toxic/nutritional)

2. Describe typical and atypical features, evaluation, and management of the most complex and least common ocular motor neuropathies and their mimics (e.g., progressive supranuclear palsy)
3. Describe typical and atypical features, evaluation, and management of the most complex and least common forms of nystagmus (e.g., surgical treatment options, using the null point in either prism or surgical therapy).

Glaucoma

Basic-level goals: Postgraduate year 1

Cognitive skills

1. Describe the epidemiology and genetics of primary open-angle glaucoma (POAG). Comprehend the pathogenesis of POAG, its risk factors, natural course, spectrum of clinical features, management, and prognosis
2. Perform screening for and evaluation of POAG
3. Comprehend the pathogenesis of primary angle-closure glaucoma (PACG), its risk factors, natural course, and spectrum of clinical features, management, and prognosis
4. Perform screening for and evaluation of PACG
5. Describe the mechanics of aqueous humor dynamics and the anatomy of the AC and its angle and of the ciliary body
6. Describe the principles of tonometry, the machines available and their strengths, drawbacks and clinical application, and understand the principles of tonography
7. Describe optic nerve and nerve fiber layer anatomy and physiology in normal and glaucomatous eyes. Recognize and evaluate typical, atypical, or multifactorial glaucomatous cupping.
8. Comprehend the fundamentals of perimetry, including kinetic and automated static perimetry. The ability to describe, interpret, and apply the results of the most advanced perimeters, including special kinetic and automated static perimetry strategies (e.g., special algorithms) in typical, atypical, or multifactorial glaucoma.
9. Describe gonioscopy, principles, different gonioscopes available and their indications, basic techniques of gonioscopy, anatomic findings, and gonioscopic features of primary and secondary glaucomas and other ocular pathologies
10. Describe the principles of medical management, including indications for, side effects and contraindications for both topical and systemic medications for simple glaucoma (e.g., POAG, PACG)
11. Describe and recognize normal-tension glaucoma ("low-tension glaucoma")
12. Describe the features of and recognize PACG and secondary angle-closure glaucoma and aqueous misdirection
13. Recognize hypotony and describe the clinical features (e.g., Seidel test for transconjunctival leakage)
14. List the main results of the major clinical trials in glaucoma (e.g., Glaucoma Laser Trial, Normal Tension Glaucoma Study, and Advanced Glaucoma Intervention Study).

Technical/surgical skills

1. Perform basic tonometry (e.g., applanation, Schiottz [if applicable], Tonopen, Airpuff) and recognize the pitfalls and artifacts of the testing
2. Perform basic gonioscopy to recognize normal angle

structures, identify angle closure, abnormalities associated with glaucomas, and other ocular pathologies

3. Perform stereo examination of the optic nerve, using 90 diopters or other lens, to recognize and evaluate the retinal nerve fiber layer and typical, atypical, or multifactorial glaucomatous optic neuropathy
4. Interpret manual (e.g., Goldmann) and automated (e.g., Humphrey, Octopus) visual fields in routine glaucoma and apply the results to a given patient
5. Perform corneal pachymetry and relate the findings to interpretation of intraocular pressure.

Standard-level goals: Postgraduate year 2

Cognitive skills

1. Describe the epidemiology and perform screening for routine and more advanced POAG and secondary open-angle glaucoma
2. Describe the treatment of disturbances of aqueous humor dynamics
3. Describe the more complex etiologies for, evaluation of, and treatment of glaucoma (e.g., angle recession, inflammatory, steroid-induced, pigmentary, pseudoexfoliative, phacolytic, neovascular, postoperative, malignant, lens particle glaucomas; plateau iris; glaucomatocyclitic crisis; iridocorneal endothelial syndromes; aqueous misdirection)
4. Describe more advanced tonometric and tonographic (if applicable) methods (e.g., diurnal curve)
5. Describe more advanced optic nerve and nerve fiber layer anatomy in primary and secondary glaucoma and recognize typical and atypical features associated with glaucomatous cupping (e.g., rim pallor, rapid progression, central acuity loss, hemianopic or other nonglaucomatous types of visual field loss)
6. Describe more advanced forms of perimetry (e.g., kinetic and automated static visual fields) and perimetry strategies (e.g., threshold testing, suprathreshold testing, special algorithms)
7. Describe the principles, indications, and more advanced anatomic findings and gonioscopic features of primary and secondary glaucomas (e.g., plateau iris, appositional closure)
8. Describe the principles of medical management of more advanced glaucomas (e.g., advanced POAG, secondary open-angle and closed-angle glaucomas, normal-tension glaucoma)
9. Describe the features of, recognize, and treat PACG and aqueous misdirection
10. Describe the clinical features of, recognize, and treat less common etiologies of ocular hypotony
11. Describe the results and apply the conclusions to clinical practice of the major clinical trials in glaucoma (e.g., Glaucoma Laser Trial, Normal Tension Glaucoma Study, and Advanced Glaucoma Intervention Study)
12. Recognize and treat the various adult secondary glaucomas
13. Comprehend the pathogenesis and identify the features of primary infantile and juvenile glaucomas
14. Describe and apply specific medical treatments of more advanced glaucoma
15. Describe the principles of laser treatments of glaucoma (e.g., indications, techniques, and complications and use of various types of laser energy, spot size, and laser wavelengths). The indications, techniques, and complications of laser iridotomy and trabeculoplasty should be known

- Describe the surgical treatment of glaucoma (e.g., trabeculectomy, trabeculotomy, combined cataract and trabeculectomy, setons, and cyclodestructive procedures, including indications, techniques, and complications).

Technical/surgical skills

- Perform YAG laser posterior capsulotomy for uncomplicated posterior capsule opacity and postlaser management
- Perform YAG laser peripheral iridotomy for routine angle-closure glaucoma and postlaser management
- Perform argon laser trabeculoplasty and postlaser management
- Perform cyclophotocoagulation and cyclocryotherapy
- Perform routine first trabeculectomy with or without antimetabolites
- Describe and manage a flat AC
- Perform routine revision of filtering blebs
- Perform and interpret newer imaging modalities (e.g., scanning laser ophthalmoscopy, scanning laser polarimetry, OCT, and anterior-segment OCT) in glaucoma.

Advanced-level goals: Postgraduate year 3

Cognitive skills

- Describe the features of the most complex and most advanced forms of POAG and secondary open-angle glaucoma
- Describe the mechanics of aqueous humor dynamics in the most advanced and complex etiologies of glaucoma (e.g., angle recession, combined or multifactorial glaucoma, traumatic or inflammatory glaucoma, pigmentary dispersion glaucoma)
- Apply in clinical practice the tonometric and tonographic methods (e.g., diurnal curve) in complicated or atypical cases of glaucoma
- Apply the most advanced knowledge of optic nerve and nerve fiber layer anatomy and describe the techniques, methods, and tools for analyzing the nerve fiber layer
- Recognize and evaluate atypical or multifactorial glaucomatous cupping (e.g., rim pallor)
- Describe, interpret, and apply the results of the most complex and advanced forms of perimetry, including special kinetic and automated static perimetry strategies (e.g., special algorithms) in atypical or multifactorial glaucoma
- Describe the principles and indications, and apply to clinical practice, the findings of gonioscopy in the most complex primary and secondary glaucomas
- Describe the principles of medical management of the most advanced and complex glaucoma (e.g., advanced POAG previously treated with medicine, laser or surgery; secondary glaucomas)
- Describe, recognize, and treat the most advanced cases of POAG (e.g., monocular patients, repeat surgical cases), normal-tension glaucoma, and secondary glaucomas (e.g., inflammatory glaucoma, angle recession)
- Describe the features of, recognize, and treat the most advanced cases of PACG and complex glaucomas (e.g., postoperative cases, secondary angle closure, and aqueous misdirection).
- Describe the clinical features of ocular hypotony and recognize and treat common and uncommon etiologies (e.g., choroidal detachment, leaking trabeculectomy bleb). Recognize and manage other

- complications of glaucoma surgery (e.g., thin-walled or leaking blebs, blebitis, and bleb-related endophthalmitis)
- Describe the results, apply the conclusions, and critically analyze the major clinical trials in glaucoma (e.g., Glaucoma Laser Trial, Normal Tension Glaucoma Study, and Advanced Glaucoma Intervention Study), as well as describe and use other publications in the management of glaucoma patients
- Recognize and treat uncommon adult secondary glaucomas
- Describe the features of and treat or refer the primary infantile and juvenile glaucomas
- Describe and apply specific medical treatments in the most complex and most advanced glaucoma cases (e.g., refractory glaucoma, monocular patients, and noncompliant patients)
- Describe the principles, indications, and complications of laser treatment of more advanced or complex glaucoma (repeat procedures)
- Describe the more advanced surgical treatment of glaucoma (e.g., trabeculectomy, combined cataract and trabeculectomy, setons, and cyclodestructive procedures, including indications, techniques, and complications)
- Learn counseling and rehabilitation of glaucoma patients, both in terms of vision and lifestyle. Facilities available through the government and social organizations should be recognized.

Technical/surgical skills

- Perform YAG or argon laser procedures in glaucoma patients (e.g., monocular patient, repeat laser, vitreous lysis, suture lysis)
- Perform laser peripheral iridotomy for more advanced glaucoma (e.g., monocular patient, acute angle closure, hazy cornea)
- Perform laser treatments (e.g., argon laser trabeculoplasty, iridoplasty) for more advanced glaucoma cases (repeat treatments, monocular patient)
- Perform cyclophotocoagulation and cyclocryotherapy for more advanced cases (e.g., prior surgery, monocular)
- Perform routine and repeat trabeculectomy with or without antimetabolites
- Describe, manage, and treat surgically, if necessary, a flat AC
- Perform more advanced techniques for the revision of filtering blebs (e.g., failing bleb, leaking bleb)
- Recognize and treat complications of glaucoma surgery blebs
- Perform postoperative procedures to facilitate the success of filtering blebs – suture lysis, releasable sutures, use of antimetabolites, etc.

Pediatric Ophthalmology and Strabismus

Basic-level goals: Postgraduate year 1

Cognitive skills

- Describe basic examination techniques for strabismus (e.g., ductions and versions, cover and uncover testing, alternate cover testing, prism cover testing)
- Describe basic visual development and visual assessment of the pediatric ophthalmology patient (e.g., central, steady, maintained fixation; illiterate E, Allen cards, Landolt C rings)

3. Describe basic anatomy and physiology of strabismus (e.g., innervation of extraocular muscles, primary actions, comitant and incomitant deviations, over-action and under-action, restrictive and parietic saccades, and pursuit movements)
4. Describe basic sensory adaptations for binocular vision (e.g., normal and anomalous retinal correspondence, suppression, horopter, Panum's area, fusion, and stereopsis)
5. Describe and recognize pseudostrabismus
6. Describe different etiologies of amblyopia (e.g., deprivation, ametropic, strabismic, anisometropic, organic)
7. Describe etiologies of esotropia (e.g., congenital, comitant and incomitant, accommodative and nonaccommodative, decompensated, sensory, neurogenic, myogenic, neuromuscular junction, restrictive, nystagmus blockage syndrome, spasm of the near, monofixation syndrome, consecutive)
8. Describe etiologies of exotropia (e.g., congenital, comitant and incomitant, decompensated, sensory, neurogenic, myogenic, neuromuscular junction, restrictive, basic divergence excess, exophoria, convergence insufficiency)
9. Describe various strabismus patterns (e.g., A or V pattern)
10. Describe etiologies, evaluation, and management of vertical strabismus (e.g., neurogenic, myogenic, neuromuscular junction, oblique over-action or under-action, dissociated vertical deviation, restrictive)
11. Describe nonsurgical treatment of strabismus
12. Describe different forms of childhood nystagmus
13. Describe features, classification, and treatment indications for retinopathy of prematurity
14. Describe etiologies and types of pediatric cataract
15. Describe and recognize ocular findings in child abuse (e.g., retinal hemorrhages) and appropriately refer to child protective services or other authorities
16. Describe common hereditary or congenital ocular motility or lid syndromes (e.g., Duane's syndrome, Marcus-Gunn jaw-winking, Brown syndrome)
17. Describe typical features of retinoblastoma
18. Describe basic features of dyslexia
19. Describe basic evaluation of decreased vision in infants and children (e.g., retinopathy of prematurity, hereditary retinal disorders, congenital glaucoma, measles, and Vitamin A deficiency)
20. Describe identifiable congenital ocular anomalies (e.g., microphthalmia, persistent fetal vasculature)
21. Describe ocular findings in inherited, metabolic disorders
 - a. Mucopolysaccharidoses (e.g., Hurler syndrome, Scheie syndrome, Hunter syndrome, Sanfilippo syndrome, Morquio syndrome, Sly syndrome)
 - b. Lipidoses (e.g., Tay-Sachs disease, Sandhoff, Niemann-Pick, Krabbe, Gaucher's, Fabry disease, metachromatic leukodystrophy)
 - c. Aminoacidurias (e.g., homocystinuria, cystinosis, Lowe and Zellweger syndromes)
22. Describe ocular findings in chromosomal abnormalities (e.g., trisomy 21, trisomy 13, trisomy 18, deletion of the short arm of chromosome 11, deletion of the long arm of chromosome 13, Cri du Chat syndrome, Turner's syndrome).
2. Assess ocular motility using testing of ductions and versions
3. Apply Hering's and Sherrington's laws
4. Perform basic measurement of strabismus (e.g., Hirschberg test, Krimsky method, cover testing, prism cover testing, simultaneous prism cover testing, alternate cover testing, Parks-Bielschowsky three-step test, Lancaster red-green test, Maddox rod testing, double Maddox rod testing)
5. Perform assessment of vision in the neonate, infant, and child
6. Recognize and apply in a clinical setting the following skills in the ocular motility examination:
 - a. Stereoacuity testing
 - b. Accommodative convergence/accommodation ratio (e.g., heterophoria method, gradient method)
 - c. Tests of binocularity and retinal correspondence
 - d. Cycloplegic refraction (retinoscopy)
 - e. Anterior- and posterior-segment examination
 - f. Basic and advanced measurement of strabismus
 - g. Cover test measurement
 - h. Assessment of vision
 - i. Teller acuity cards
 - ii. Fixation preference test
 - iii. Standard subjective visual acuity tests
 - iv. Induced tropia test
7. Assist a primary surgeon in performing extraocular muscle surgery including:
 - a. Recession
 - b. Resection
 - c. Muscle weakening (e.g., tenotomy) and strengthening (e.g., tuck) procedures
 - d. Transposition
 - e. Use of adjustable sutures.

Standard-level goals: Postgraduate year 2

Cognitive skills

1. Describe basic and more advanced strabismus examination techniques (e.g., 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 (e.g., blink to light or threat, measures of fixation and following behavior, objective measures of visual acuity)
3. Describe more advanced anatomy and physiology of strabismus (e.g., torsion, tertiary actions, and consecutive deviations)
4. Describe more advanced sensory adaptations (e.g., anomalous head position)
5. Describe basics of binocular sensory testing (e.g., Titmus stereo testing, Randot stereo testing, Worth four-dot, Bagolini lenses, afterimage testing)
6. Describe and recognize different etiologies of amblyopia
7. Describe and recognize etiologies of esotropia
8. Describe and recognize etiologies of exotropia
9. Describe and recognize various strabismus patterns (e.g., A or V pattern)
10. Describe and recognize the etiologies of vertical strabismus
11. Describe and utilize the nonsurgical treatment of strabismus and amblyopia (e.g., patching, atropine penalization, Fresnel and grind-in prism therapy)
12. Describe and recognize the different forms of childhood nystagmus (e.g., sensory, motor, congenital, acquired)
13. Describe and recognize retinopathy of prematurity (e.g., stages, treatment indications)

Technical/surgical skills

1. Perform an extraocular muscle examination based on knowledge of the anatomy and physiology of ocular motility

14. Describe and recognize etiologies and types of pediatric cataract (e.g., congenital, traumatic, hereditary, idiopathic)
15. Describe and recognize less common hereditary or malformative ocular anomalies and syndromes (e.g., Mobius, Goldenhar syndrome)
16. Describe and recognize typical features of retinoblastoma (e.g., differential diagnosis, evaluation, treatment indications and types)
17. Describe the main features of dyslexia and its relationship to vision
18. Describe basic evaluation and differential diagnosis of decreased vision in infants and children (e.g., retinal and optic nerve etiologies, amblyopia)
19. Describe recognizable causes of blindness in infants (e.g., albinism, optic nerve hypoplasia, achromatopsia, Leber's congenital amaurosis, retinal dystrophy, congenital optic atrophy)
20. Describe etiology, evaluation, and management of congenital infections (e.g., toxoplasmosis, rubella, cytomegalovirus, syphilis, herpes)
21. Describe and recognize the common causes of pediatric uveitis.

Technical 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 (e.g., bilateral or multiple cranial neuropathy, myasthenia gravis, thyroid eye disease)
3. Apply Hering's and Sherrington's laws in more advanced cases (e.g., pseudoparesis of the contralateral antagonist, enhancement of ptosis in myasthenia gravis)
4. Perform more advanced measurements of strabismus (e.g., double Maddox rod testing, Lancaster red green testing, use of synoptophore or amblyoscope)
5. Perform assessment of vision in more difficult strabismus patients (e.g., uncooperative child, mentally impaired, nonverbal or preverbal)
6. Perform basic extraocular muscle surgery:
 - a. Exercise surgical judgement for the indications and contraindications for strabismus surgery
 - b. Perform preoperative assessment and intraoperative techniques and describe intraoperative and postoperative complications of strabismus surgery
 - c. Perform the following strabismus surgeries:
 - i. Recession
 - ii. Resection
 - iii. Muscle weakening (e.g., tenotomy) and strengthening (e.g., tuck) procedures
 - iv. Transposition
 - v. Use of adjustable sutures
 - d. Manage the complications of strabismus surgery (e.g., slipped muscle, anterior-segment ischemia).

Advanced-level goals: Postgraduate year 3

Cognitive skills

1. Describe and perform the most advanced strabismus examination techniques (e.g., complicated prism cover testing in multiple cranial neuropathies, patients with nystagmus, dissociated vertical deviation, double Maddox rod testing)
2. Perform the most advanced techniques for the assessment of visual development in complicated or noncooperative

- pediatric ophthalmology patients (e.g., less common objective measures of visual acuity, electrophysiologic testing)
3. Apply the most advanced knowledge of strabismus anatomy and physiology (e.g., spiral of Tillaux, secondary and tertiary actions, spread of comitance) in the evaluation of patients
4. Describe clinical application of the most advanced sensory adaptations (e.g., anomalous head position, anomalous retinal correspondence)
5. Recognize and treat the most complicated etiologies of amblyopia (e.g., refraction noncompliance, patching failures, and pharmacologic penalization)
6. Recognize and treat the most complex etiologies of esotropia (e.g., optical, prism induced, postsurgical/consecutive)
7. Recognize and treat the most complex etiologies of exotropia (e.g., supranuclear, paralytic pontine exotropia, consecutive)
8. Recognize and treat the most complex strabismus patterns (e.g., aberrant regeneration, postsurgical, thyroid ophthalmopathy, and myasthenia gravis)
9. Recognize and treat the most complex etiologies of vertical strabismus (e.g., skew deviation, postsurgical, restrictive)
10. Apply nonsurgical treatment (e.g., patching, atropine penalization) of more complicated forms of amblyopia (e.g., noncompliant, patching failures)
11. Recognize, evaluate, and treat the most complex forms of childhood nystagmus (e.g., sensory, spasmus nutans, associated with neurologic or systemic diseases)
12. Recognize and treat (or refer for treatment) complex retinopathy of prematurity (e.g., stages, treatment indications, retinal detachment)
13. Recognize and treat (or refer for treatment) uncommon etiologies and types of pediatric cataract (e.g., congenital, traumatic, metabolic, inherited)
14. Recognize and appropriately evaluate the more complex hereditary ocular syndromes (e.g., bilateral Duane syndrome, Moebius syndrome)
15. Recognize and treat (or refer for treatment) patients with complicated retinoblastoma (e.g., bilateral cases, monocular patient, treatment failure, pineal involvement)
16. Recognize and evaluate the less common congenital ocular anomalies (e.g., unusual genetic syndromes)
17. Apply the most advanced principles of binocular vision and amblyopia (e.g., 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 (e.g., 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 (e.g., congenital deformities, lid lacerations, lid tumors)
22. Recognize and treat (or refer) pediatric orbital diseases (e.g., orbital tumors, orbital fractures, rhabdomyosarcoma, severe congenital orbital malformations).

Technical/surgical skills

1. Perform more complex extraocular muscle surgery (e.g., vertical and horizontal muscle surgery, reoperations)

2. Describe indications and contraindications for more complex strabismus surgery
3. Describe and perform the preoperative assessment and intraoperative techniques and describe postoperative complications for more complicated strabismus surgery (e.g., reoperations, slipped muscle)
4. Describe indications for and perform adjustable sutures in more complicated cases (e.g., thyroid ophthalmopathy)
5. Describe and manage more complex complications of strabismus surgery (e.g., globe perforation, endophthalmitis, and overcorrection).

Optics

General educational objectives

Understand the principles, concepts, instruments, and methods of optics outlined below and be able to apply them in the clinical practice.

Basic-level goals: Postgraduate year 1

Physical optics

1. Properties of light
 - a. Electromagnetic spectrum
 - b. Wave theory
 - c. Photon-particle theory
2. Diffraction
3. Interference and coherence
4. Resolution
5. Polarization
6. Scattering
7. Transmission and absorption
8. Photometry
9. Lasers
10. Illumination
11. Image quality
12. Brightness and radiance
13. Light propagation – Optical media and refractive index.

Geometric optics

1. Reflection (mirrors)
 - a. Laws of reflection
 - b. Reflection at a plane surface (image and field of a plane mirror)
 - c. Reflection at curved surfaces (focal point and focal length of a spherical mirror)
 - d. Images and objects as light sources
 - e. Refractive index
 - f. Multiple lens system
2. Refraction
 - a. Laws of refraction (Snell's law)
 - i. Passage of light from one medium to another
 - ii. Absolute index of refraction
 - iii. Total internal reflection
 - b. Refraction at a plane surface
 - c. Refraction at curved surfaces
 - d. Critical angle and total internal reflection
 - e. Image jump and displacement
3. Prisms
 - a. Definition
 - b. Notation of prisms (e.g., prism diopters)
 - c. Uses in ophthalmology (diagnostic and therapeutic)
 - d. Types of prisms (plane, parallel, plate)
 - e. Prentice's rule

- f. Fresnel prism
- g. Refraction of light through a prism
- h. Thin prisms
- i. Prismatic effect of lenses
4. Spherical lenses
 - a. Cardinal points
 - b. Thin lens formula
 - c. Thick lens formula
 - d. Formation of the image
 - e. Vergence of light (diopter, convergence, divergence, vergence formula)
 - f. Concave and convex
 - g. Magnification (linear, angular, relative size, electronic)
 - h. Spherical decentration and prism power
 - i. Lens form
 - j. Binocular balancing
 - k. Refracting the basic low-vision patient
5. Astigmatic lenses
 - a. Cylindrical lenses
 - i. Sphero-cylinder lenses and surfaces
 - ii. Cross-cylinders (e.g., Jackson cross-cylinder)
 - b. Maddox rod
 - c. Toric lenses
 - d. Conoid of Sturm
6. Notation of lenses
 - a. Spectacle prescribing
 - b. Simple transposition
 - c. Toric transposition
7. Identification of unknown lenses
 - a. Neutralization
 - b. Focimeter
 - c. Geneva lens measure
8. Aberrations of lenses
 - a. Correction of aberrations relevant to the eye (spherical, coma, astigmatism, distortion, pantoscopic tilt)
 - b. Duochrome test
9. Lens materials.

Clinical optics

1. Optics of the eye
2. Transmittance of light by the optic media
3. Schematic and reduced eye
4. Pupillary response and its effect on the resolution of the optical system (Stiles-Crawford effect)
5. Visual acuity
 - a. Distance- and near-acuity measurement
 - b. Minimal (visible, perceptible, separable, legible)
 - c. Vernier acuity
6. Contrast sensitivity
7. Catoptric images
8. Emmetropia
9. Accommodation
10. Purkinje shift
11. Pinhole
12. Ametropia
 - a. Myopia
 - b. Hypermetropia (hyperopia)
 - c. Astigmatism
 - d. Anisometropia
 - e. Aniseikonia (Knapp's rule)
 - f. Aphakia
 - g. Optical parameters affecting retinal image size

13. Accommodative problems
 - a. Insufficiency
 - b. Excess
 - c. AC/A ratio
14. Refractive errors
 - a. Prevalence
 - b. Inheritance
 - c. Changes with age
 - d. Surgically induce.
15. Correction of ametropia
 - a. Spectacle lenses
 - b. CLs
 - c. IOLs
 - d. Principles of refractive surgery
16. Problems of spectacles in aphakia
17. Effect of spectacles and CL correction on accommodation and convergence (amplitude, near-point, far-point)
18. Effective power of lenses
19. Back vertex distance (BVD)
20. Spectacle magnification
21. Calculation of IOL power
22. Presbyopia (measuring for near adds)
23. Low-vision aids
 - a. High reading addition
 - b. Magnifying lenses
 - c. Telescopic aids – Galilean telescope, Keplerian telescope.

Clinical refraction

1. Retinoscopy
2. Subjective refraction
3. Measurement of BVD
4. Muscle balance tests
5. Accommodative power
6. Measurement of interpupillary distance (IPD)
7. Decentration of lenses and prismatic effect
8. Best form lens
9. Prescribing multifocal lenses
10. Prescribing for children
11. Cycloplegic refraction.

Instruments and tests

1. Direct ophthalmoscope
2. Indirect ophthalmoscope
3. Retinoscope
4. Focimeter
5. Simple magnifying glass (loupe)
6. Lensmeter
7. Glare and contrast testing
8. Potential acuity meter
9. Automated refractor
10. Slit-lamp biomicroscope (including methods of examination)
11. Stereo tests
12. Corneal topographic measurements (Placido disc, keratometer, automated corneal topography)
13. Applanation tonometer
14. Specular microscope
15. Operating microscope
16. Zoom lens principle
17. Corneal pachymeter
18. Lees' screen/Hess chart
19. Synoptophore

20. Lenses used for fundus biomicroscopy (panfunduscope, Goldmann lens, Hruby lens, 90-D lens, etc.)
21. Fundus camera
22. Gonioscope
23. Tonometers
24. Color vision tests (Ishihara color plates; Hardy-Rand-Rittler plates, Farnsworth-Munsell testing).

Technical skills

Proficiency in the accurate and reproducible use of:

1. Direct ophthalmoscope
2. Indirect ophthalmoscope
3. Retinoscope
4. Focimeter
5. Simple magnifying glass (loupe)
6. Lensmeter
7. Potential acuity meter
8. Slit-lamp biomicroscope (including methods of examination)
9. Applanation tonometer
10. Operating microscope
11. Corneal pachymeter
12. Lees screen/Hess chart
13. Synoptophore
14. Lenses used for fundus biomicroscopy (panfunduscope, Goldmann lens, Hruby lens, 78-D lens, 90-D lens, etc.)
15. Gonioscope
16. Tonometers
17. Color vision tests (Ishihara color plates; Hardy-Rand-Rittler plates, Farnsworth-Munsell testing)

Standard-level goals: Postgraduate year 2

Improve proficiency in basic-level skills

Proficiency in the accurate and reproducible use of:

1. Direct ophthalmoscope
2. Indirect ophthalmoscope
3. Retinoscope
4. Focimeter
5. Simple magnifying glass (loupe)
6. Lensmeter
7. Glare and contrast testing
8. Potential acuity meter
9. Automated refractor
10. Slit-lamp biomicroscope (including methods of examination)
11. Stereo tests
12. Corneal topographic measurements (Placido disc, keratometer, automated corneal topography)
13. Applanation tonometer
14. Specular microscope
15. Operating microscope
16. Zoom lens principle
17. Corneal pachymeter
18. Lens screen/Hess chart
19. Synoptophore
20. Lenses used for fundus biomicroscopy (panfunduscope, Goldmann lens, Hruby lens, 90-D lens, etc.)
21. Fundus camera
22. Gonioscope
23. Tonometers
24. Manual static and kinetic and automated static visual fields
25. Color vision tests (Ishihara color plates; Hardy-Rand-Rittler plates, Farnsworth-Munsell testing).

Advanced-level goals: Postgraduate year 3

Apply, at the highest level of understanding, the relevant optics information in the following situations:

1. Refraction and prescribing of spectacles and CLs
2. IOL calculation
3. Cataract surgery
4. Use of prisms for diplopia
5. Low-vision aid prescribing

Proficiency in the accurate and reproducible use of:

1. Direct ophthalmoscope
2. Indirect ophthalmoscope
3. Retinoscope
4. Focimeter
5. Simple magnifying glass (loupe)
6. Lensmeter
7. Glare and contrast testing
8. Potential acuity meter
9. Automated refractor
10. Slit-lamp biomicroscope (including methods of examination)
11. Stereo tests
12. Corneal topographic measurements (Placido disc, keratometer, automated corneal topography)
13. Applanation tonometer
14. Specular microscope
15. Operating microscope
16. Zoom lens principle
17. Corneal pachymeter
18. Lens screen/Hess chart
19. Synoptophore
20. Lenses used for fundus biomicroscopy (panfunduscope, Goldmann lens, Hruby lens, 90-D lens, etc.)
21. Fundus camera
22. Fundus fluorescein angiography
23. OCT
24. Gonioscope
25. Tonometers
26. Manual static and kinetic and automated static visual fields
27. Heidelberg retinal tomogram, GDx nerve fiber analyzer, OCT
28. Color vision tests (Ishihara color plates; Hardy-Rand-Rittler plates, Farnsworth-Munsell testing).

Retinoscopy and Refraction

General educational objectives

1. Identify the principles and indications for retinoscopy
2. Perform the technique of retinoscopy
3. Identify media opacities with retinoscopy
4. Perform an integrated refraction based upon retinoscopic results.

Basic-level goals: Postgraduate year 1

1. Describe the major types of refractive errors
2. Describe basic ophthalmic optics and optical principles of refraction and retinoscopy
3. Perform retinoscopy for detecting simple refractive errors
4. Describe the indications for and use trial lenses or a phoropter for simple refractive error
5. Perform objective retinoscopy with and without cycloplegia
6. Perform subjective refraction
7. Prescribe for basic refractive conditions (e.g., for myopia, hyperopia, near-vision add)
8. Describe the basic principles of a keratometer.

Standard-level goals: Postgraduate year 2

1. Describe more complex types of refractive errors, including postoperative refractive errors
2. Perform more advanced refraction techniques and prescribe (e.g., astigmatism, complex refractions, asymmetric accommodative add)
3. Describe the more advanced ophthalmic optics and optical principles of refraction and retinoscopy (e.g., postkeratoplasty, postcataract extraction)
4. Perform objective and subjective refraction techniques for more complex refractive errors, including astigmatism and postoperative refractive error, and prescribe
5. Describe and 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 (e.g., advanced and irregular astigmatism, vertex distance)
6. Use the keratometer for detection of more advanced refractive error
7. Measure BVD, muscle balance, accommodative power, IPD, lens decentration.

Advanced-level goals: Postgraduate year 3

1. Describe the most complex types of refractive errors, including postoperative refractive errors, postkeratoplasty, and refractive surgery
2. Perform most advanced refraction techniques and prescribe (e.g., irregular astigmatism, pre- and post-refractive surgery, refraction in children, multifocal correction)
3. Describe the most advanced ophthalmic optics and optical principles of refraction and retinoscopy, including higher order aberrations.

Contact Lenses

Basic-level goals: Postgraduate year 1

General educational objectives

1. Perform a basic CL history and examination and be aware of additional basic tests and questions that are required for CL patients with more complex needs
2. Perform the techniques of retinoscopy, refraction, and over-refraction in the routine CL patient
3. Describe the optics of the soft CL (SCL) and hard CL (e.g., rigid gas permeable [RGP] CL), base curve changes, the lacrimal lens, and the optic zone
4. Describe conversion of a spectacle prescription (Rx) to a CL Rx, including method of converting from plus to minus cylinder
5. Describe basic CL design, using appropriate terminology
6. Describe techniques for and perform basic CL fitting
7. Describe selection of CL candidates with noncomplex needs
8. Use auxiliary CL instruments and tests (e.g., trial set, fluorescein testing)
9. Perform CL verification for vision correction, fit, and comfort
10. Describe contraindications for CL use.

Cognitive skills

1. Describe fundamentals of ophthalmic optics in CL management (e.g., CL choices, techniques for fitting individuals)
2. List the indications for CLs in noncomplex cases
3. Describe CL choices and techniques for fitting individuals with noncomplex CL needs.

Technical/surgical skills

1. Perform advanced retinoscopy techniques in a CL patient
2. Perform advanced refraction techniques in a CL patient, including diagnostic fitting
3. Perform techniques to verify and inspect CLs
4. Utilize appropriate teaching skills to instruct patients in the safe insertion, removal, and care of CLs.

Standard-level goals: Postgraduate year 2*General educational objectives*

1. Perform a more advanced CL history and examination, employing additional tests and questions appropriate for patients with more complex CL needs (e.g., keratoconus, difficult CL fittings)
2. Perform retinoscopy and refraction in the CL patient with more complex needs (e.g., keratoconus, postkeratoplasty)
3. Describe the more advanced optics of the SCLs and hard CLs (e.g., RGP CL), base curve changes, the lacrimal lens, and the optic zone
4. Describe more advanced CL design (e.g., special lenses and special CL shapes or materials)
5. Describe and perform more advanced CL fitting (e.g., postkeratoplasty)
6. Describe selection of CL candidates with more complex needs (e.g., postsurgical)
7. Use auxiliary CL instruments in patients with more complex needs (e.g., postsurgical topography)
8. Perform CL verification for vision, fit, and comfort in therapeutic CL cases.

Cognitive skills

1. Describe more advanced concepts of ophthalmic optics in CL
2. Describe indications for more advanced CL (e.g., therapeutic lenses).

Technical/surgical skills

1. Perform more advanced retinoscopy techniques in a CL patient
2. Perform more advanced refraction techniques in CL patient, including diagnostic fitting
3. Perform advanced techniques to verify and inspect CLs in patients with complex CL needs
4. Perform more advanced CL fitting in patients with complex needs (e.g., keratoconus, CL in children, active corneal disease)
5. Describe and use the CL instruments in more complex cases
6. Describe the more advanced CL complications (e.g., microbial keratitis, sterile corneal infiltrates, and preservative toxicity)
7. Perform appropriate CL selection (e.g., material selection, CL modification)
8. Perform corneal topography to fit CLs.

Advanced-level goals: Postgraduate year 3*General educational objectives*

1. Perform the most advanced techniques in CL history and examination and understand what additional tests and questions are needed during the most complex CL examination (e.g., postkeratoplasty, multiple surgery, post-refractive, complex keratoconus fitting, active corneal disease)
2. Perform retinoscopy and refraction in the CL patient with the most complex needs (e.g., keratoglobus, keratoconus,

following open globe repair [e.g., corneal laceration] or multiple keratoplasty)

3. Describe the most advanced optics and applications of SCLs and hard CLs (e.g., piggyback CL)
4. Describe the most advanced CL design, using appropriate terminology (e.g., special fittings, special lenses for difficult-to-fit patients)
5. Describe indications for and perform the most advanced CL fitting (e.g., postmultiple keratoplasty or traumatic corneal repair)
6. Describe indications for and apply the most complex CL in special circumstances or for candidates presenting increased level of difficulty (e.g., postsurgical patients, children)
7. Use the auxiliary CL instruments in patients with the most complex needs (e.g., topography, fluorescein testing, diagnostic lenses).

Cognitive skills

1. Describe the differences among CL material choices
2. Describe methods of modifying a CL to improve comfort, vision, or physiological response
3. Evaluate and manage CL-induced complications
4. Perform and interpret corneal topography in CL fitting

Technical/surgical skills

1. Perform CL modification in complex cases
2. Select the appropriate CL in more complex cases.

Ophthalmic Histopathology**Basic-level goals: Postgraduate year 1***Cognitive skills*

1. Describe basic ocular anatomy and identify the histology of the major structures of the eye (e.g., conjunctiva, sclera, cornea, AC angle, iris, ciliary body, lens, vitreous, retina, retinal pigment epithelium, choroid, optic nerve)
2. Describe basic pathophysiology of the common disease processes of the eye and identify the major histologic findings of each (e.g., infection, inflammation, neoplasm)
3. Identify the histology of important intraocular and adnexal diseases (e.g., endophthalmitis, retinoblastoma, choroidal melanoma, microbial keratitis).

Technical skills (for an ocular pathology laboratory, as available)

1. Describe appropriate steps in the basic handling and processing of gross specimens in the ocular pathology laboratory (e.g., basic preparation of the specimen) and demonstrate proficiency in these steps in the laboratory
2. Describe specific information necessary for communication with the pathologist regarding special handling of specimens for special stains or studies
3. Describe indications for frozen sections in ocular pathology
4. Perform cutting and gross examination of whole globes
5. Participate under supervision in the microscopic examination of ophthalmology specimens from active cases.

Standard-level goals: Postgraduate year 2*Cognitive skills*

1. Describe more advanced ocular anatomy and identify the histology of the major and minor structures of the eye (e.g., conjunctival glands, normal pigment, and common variants)

- Describe more advanced pathophysiology of the disease processes of the eye and identify the major histologic findings of each (e.g., fungal keratitis, skin and adnexal neoplasms, and less common intraocular tumors)
- Identify histology of the less common but potentially vision- or life-threatening intraocular and adnexal diseases (e.g., temporal arteritis, fungal endophthalmitis, extraocular spread of intraocular tumor, metastatic disease to the eye)
- Describe more advanced techniques in ocular histopathology (e.g., electron microscopy, cytology, immunohistochemistry, flow cytometry, tumor-free margins).

Technical/surgical skills

- Describe appropriate steps in the more advanced handling and special processing of gross specimens in the ocular pathology laboratory
- Describe specific indications for special handling and communicate to the pathologist the necessity for special handling of specimens for special stains or studies (e.g., electron microscopy, immunohistochemistry, flow cytometry, cytology)
- Describe indications and perform and prepare a biopsy specimen for frozen section in ocular pathology
- Prepare a basic histologic specimen for review by the pathologist
- Participate as an "at-the-elbow" observer during microscopic examination of active ophthalmology cases and perform microscopic examination of a specimen with and without direct supervision.

Advanced-level goals: Postgraduate year 3

Cognitive skills

- Describe the most advanced ocular anatomy and identify histology of the major and minor structures of the eye and their less common "normal" variants (e.g., pars plana cysts, iris heterochromia, cobblestone degeneration of the retina)
- Describe the most advanced, less common, or more complex pathophysiology of the disease processes of the eye and identify major histologic findings of each (e.g., inflammatory pseudotumor, lymphoma, artifacts of processing)
- Identify the histology of the least common but potentially vision- or life-threatening intraocular and adnexal diseases (e.g., healed giant cell arteritis, mimics and masqueraders of inflammation or neoplasm, uncommon benign and malignant neoplasms).

Technical/surgical skills

- Describe and perform appropriate steps for handling gross or cytologic specimens in the ocular pathology laboratory
- Perform preoperative, intraoperative, and postoperative consultation with the pathologist, regarding specific indications for special stains or processing (e.g., orientation of specimen, special handling)
- Perform and interpret the pathologic report of frozen section in ocular pathology.
- Perform the preparation of basic and more advanced histologic specimens for review by the pathologist (e.g., simple or special stains or fixation methods)
- Participate as an "at-the-elbow" observer during the microscopic examination of active ophthalmology cases
- Perform microscopic examination of a specimen with and without direct supervision and provide a relevant differential diagnosis.

Ocular Oncology

Basic-level goals: Postgraduate year 1

Cognitive skills

- Describe the basic categorization of common extraocular and intraocular tumors
- Describe the differential diagnosis, epidemiology, evaluation, and management of leukocoria (e.g., inflammatory, infectious, neoplastic, congenital, persistent fetal vasculature, cataract, Coats' disease, vitreous hemorrhage, retinal detachment)
- Describe major diagnostic features of major intraocular tumor types (e.g., retinoblastoma, choroidal melanoma, metastatic lesions) and describe the differentiating features of similar lesions.

Technical/surgical skills

- Perform slit-lamp, ophthalmoscopic, and ocular transillumination examination of patients with intraocular tumors (e.g., choroidal melanoma)
- Recognize an ocular tumor and refer appropriately.

Standard-level goals: Postgraduate year 2

Cognitive skills

- Describe management options for different intraocular tumors
- Describe the findings of the Collaborative Ocular Melanoma Study (COMS)
- Describe the classification of retinoblastoma and its treatment
- Describe basic histopathology of intraocular tumors
- List the differential diagnoses for tumors of the iris, ciliary body, choroid, retina and optic disc (e.g., melanoma, retinoblastoma, hemangioma, melanocytoma)
- Describe diagnostic techniques for common intraocular tumors (e.g., physical examination, imaging, laboratory, oncology referral)
- Describe the prognostic significance of different types of ocular tumors and be able to guide evaluation for systemic involvement.

Technical/surgical skills

- Perform indirect ophthalmoscopy in the diagnosis and localization of intraocular tumors
- Perform transillumination for intraocular tumor
- Describe indications for an examination under anesthesia for pediatric intraocular tumors
- Describe indications for A-scan and B-scan echography of intraocular mass lesions
- Describe indications for fluorescein angiography of intraocular tumors
- Describe indications for destruction or excision of conjunctival, corneal, and intraocular tumors
- Describe indications for laser photocoagulation for intraocular tumors
- Describe indications for and techniques of transpupillary thermal therapy for intraocular tumors
- Recognize major histopathologic appearance of common intraocular tumors
- Describe the indications for surgical or other therapeutic procedures and their complications, and for referral, if necessary, for:

- a. Plaque or other radiotherapy
- b. Iridectomy and iridocyclectomy
- c. Resection of conjunctival tumors
11. Perform an enucleation
12. Describe indications for and techniques and complications of radiation therapy for ocular tumors (e.g., radioactive plaque localization, external beam radiation, radiation retinopathy)
13. Discuss various treatment options with patients and their families in a detailed, ethical, and compassionate manner.

Advanced-level goals: Postgraduate year 3

Cognitive skills

1. Describe management options for unusual intraocular tumors (e.g., choroidal metastasis, choroidal osteoma)
2. Apply the findings of the COMS
3. Recognize, evaluate, and treat most forms of extraocular and intraocular tumors.

Technical/surgical skills

1. Perform indirect ophthalmoscopy for the diagnosis and localization of intraocular tumors before treatment
2. Describe indications for and perform an examination under anesthesia for pediatric intraocular tumors (e.g., retinoblastoma)
3. Describe indications for and interpret A-scan and B-scan echography of intraocular mass lesions
4. Describe indications for and interpret fluorescein angiography of intraocular tumors
5. Describe indications for and perform excision or other treatment of conjunctival, corneal, and intraocular tumors
6. Describe indications for and perform laser photocoagulation for intraocular tumors
7. Recognize major histopathologic appearance of common and less common intraocular tumors
8. Describe indications for surgical procedures and their complications and be able to perform or refer for:
 - a. Plaque radiotherapy
 - b. External beam radiotherapy
 - c. Iridectomy and iridocyclectomy
 - d. Resection or cryotherapy of conjunctival tumors or use of antimetabolite eye drops
 - e. Transpupillary thermotherapy
9. Perform a complicated enucleation (e.g., small orbit, scar tissue) or exenteration.

Low-Vision Rehabilitation

Basic-level goals: Postgraduate year 1

Cognitive skills

1. Describe low-vision assessment techniques (e.g., ETDRS charts, Sloane charts)
2. Describe significant comorbidities that impact low-vision rehabilitation

3. Describe various low-vision aids
4. Describe the optics of low-vision devices
5. Be sensitive to psychological and emotional aspects of visual impairment
6. Describe challenges commonly encountered by individuals with visual impairments
7. Prescribe simple but appropriate rehabilitative therapies and optical devices to help the patient meet their goals (e.g., magnification, illumination)
8. Describe functional implications of various visual system pathologies and diseases
9. Describe visual field enhancing techniques for hemianopic field loss
10. Describe the difference between visual acuity testing at both distance and near and contrast sensitivity testing
11. Describe the evaluation of and rationale for licensing automobile drivers who are visually impaired and understand the local-licensing regulations
12. Describe evaluation of visual acuity and visual field for determination of disability.

Standard-level goals: Postgraduate year 2

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 (e.g., closed circuit television, magnification, large print, Braille, computers with artificial speech)
3. Describe the more advanced optics of low-vision devices.

Technical/surgical skills

1. Prescribe more complex rehabilitative therapies and optical devices to help the patient meet their goals
2. Apply and prescribe visual field enhancing techniques for hemianopic field loss
3. Perform evaluation of vision assessment in licensing drivers who are visually impaired
4. Evaluate visual acuity and visual field for the determination of disability (for legal and insurance purposes)
5. Demonstrate low-vision devices and educate low-vision patients on the uses and limitations of these devices.

Advanced-level goals: Postgraduate year 3

Cognitive skills

1. Treat significant comorbidities that impact low-vision rehabilitation
2. Describe indications for the most complex low-vision aids
3. Apply more complex principles of optics of low-vision devices.

Technical/surgical skills

1. Prescribe the most complex rehabilitative therapies and optical devices to help the patient meet their goals
2. Apply and prescribe the most complex visual field enhancing techniques for hemianopic field loss.