

# Ophthalmology Residency

Curriculum and Competencies Goals.  
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UPR-SOM.



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## Introduction.

The purpose of our Residency is to train the medical doctors who will take care of the visual health of our country. This entitles a great responsibility; it requires not only providing the core knowledge in ophthalmology, but also a set of competencies that will be described in detail in this curriculum.

We have based this curriculum in the Principles and Guidelines of a Curriculum for Education of the Ophthalmic Specialist as published by the International Council of Ophthalmology; although adapted to our environment, it follows very closely the original curriculum.

Our Residency provides within a 36 months period the knowledge, skills, an appreciation for research, plus a life-long commitment with learning, education and fidelity to our patients. These goals are summarized by the following core competencies.

- A. Medical Knowledge.
- B. Patient Care.
- C. Practice-based learning.
- D. Interpersonal and communication skills.
- E. Professionalism.
- F. System-based practice.

The Medical Knowledge and Patient Care Competencies are described in detail within this document for each area and level of training under the headings of Cognitive Skills and Technical Skills respectively. The rest of the Competencies are common to all areas of ophthalmology, they are specified after this introduction.

The following tools will address the goals set for the above six competencies within the 36 months of training:

1. A set of lectures tailored to cover each of the several sections of knowledge in ophthalmology. These lectures are given at least twice during the 36 months of training, allowing a uniform exposure to all residents.
2. Independent Study following the HSRC of the AAO as a guide, closely monitored during each clinical rotation by the faculty.
3. Interaction between the faculty and residents during clinics, ER/on-call duties and at the OR.
4. Journal club sessions.
5. Review of the Home Study Review Course (HSRC)
6. Case presentations.
7. Discussion of complicated cases.
8. Clinical-Pathologic correlation sessions.

Completion of our Competencies goals is measure by:

1. Ophthalmic Knowledge Assessment Program (OKAP).
2. Ophthalmic Clinical Evaluation Exam (OCEX).
3. Journal Club and Case Presentations Evaluations.
4. On call Assessment Tool (OCAT).
5. Operating Room Surgical Skills Assessment (ORSSA).
6. Resident's Portfolio.

## Common Competencies.

### C. Practice Based Learning and Improvement.

1. To analyze the practice experience and perform practice-based improvement activities using a systematic methodology.
2. To locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems.
3. To obtain and use information about their own population of patients and the larger population from which their patients are drawn.
4. To use information technology to manage information, access on-line medical information; and support self-education.
5. Facilitate the learning of students and other health care professionals

### D. Interpersonal and Communication Skills.

1. 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.
2. All residents should establish and maintain rapport with patients, peers, faculty, nurses and ancillary personnel.
3. Residents will show sensitivity and compassion to patients' fears, and anxieties, as well as protect their need for privacy.
4. Residents must be proficient in communicating their patients and patients' relatives, the pertinent diagnosis, actual conditions, therapies and alternatives to it as well as prognosis in a clear way that is understandable to all of them.
5. All residents should explain the management plans in a way that motivates the patient's willing participation.
6. Pro-active behavior to promote the participation of all the health team, the patient and his/her relatives in the healing process is mandatory.
  - a) Create and sustain a therapeutic and ethically sound relationship with patients.
  - b) Use effective listening skills and elicit and provide information using effective nonverbal, explanatory, questioning, and writing skills.
  - c) Work effectively with others as a member or leader of a health care team or other professional group.

### E. 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:

1. Demonstrate respect, compassion, and integrity; a responsiveness to the needs of patients and society that supersedes self-interest; accountability to patients, society, and the profession; and a

- commitment to excellence and on-going professional development.
2. Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent, and business practices.
  3. Demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities.

F. System Based Practice.

At the end of their training all residents should:

1. Demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.
2. Understand how their patient care and other professional practices affect other health care professionals, the health care organization and the larger society, and how these elements of the system affect their own practice.
3. Know how types of medical practice and delivery systems differ from one another, including methods of controlling health care costs and allocating resources.
4. Practice cost-effective health care and resource allocation that do not compromise quality of care.
5. Advocate for high quality patient care and assist patients in dealing with system complexities.
6. 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.
7. Demonstrate knowledge of the sources of financing for Puerto Rico and U. S. health care, including Medicare, Medicaid, the VAH, the Dpt. of Defense, the Puerto Rico Health Dpt. as well as Private health plans and the Puerto Rico Health Reform plan.
8. Knows how health care is delivered in Puerto Rico and U.S. in different venues such as hospitals, medical offices, and state-sponsored units
9. Demonstrate knowledge of the regulatory environment including state licensing authority, State and local Public Health rules and regulations, and regulatory agencies such as HCFA, PRO and JCAHO.
10. Demonstrate ability to work with social services and public health agencies, religious Institutions, police and other community organizations as appropriate in assisting their patients.
11. Demonstrate knowledge of basic practice management principles such as budgeting, record keeping, billing systems, and the recruitment, hiring, supervision and management of staff.



## Community Eye Health

Basic , Standard , and Advanced Levels YEARS: 1,2 & 3

### A. *Cognitive Skills*

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

1. Explain the World Health Organization (WHO) definition of blindness and low vision.\*\*
2. Outline the magnitude and distribution of global blindness.
3. List the major causes of global blindness
4. Describe the magnitude of blindness in the resident's own country.\*\*
5. List the major causes of blindness in the resident's own country.\*\*
6. Outline the structure of the health service, and how eye care services are integrated into this structure.\*\*
7. Outline the social and economic implications of visual impairment and the impact on quality of life.\*\*

#### **Cataract**

1. Describe the prevalence and incidence of blindness due to cataract.\*\*\*
2. List the WHO's recommendations for the visual acuity outcomes following cataract surgery.\*\*

#### **Refractive error**

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

#### **Low vision**

1. Define low vision.\*\*
2. Describe the prevalence of low vision.\*\*
3. Outline the strategy for including low vision in a blindness prevention program.\*\*
4. List the resources available for people with low vision.\*\*

### **Childhood blindness**

1. Define childhood blindness.\*\*
2. Describe the prevalence of childhood blindness in different economic settings.\*\*
3. Describe the incidence of childhood blindness.\*\*
4. Describe the classification of the causes of childhood blindness.\*\*

### **Trachoma**

1. Describe the risk factors for trachoma.\*\*
2. Outline the WHO clinical grading of trachoma.\*\*
3. Describe the magnitude of trachoma, and describe the affected regions.\*\*

### **Onchocerciasis**

1. Describe the risk factors for onchocerciasis.\*\*
2. Describe the magnitude of onchocerciasis, and describe the affected regions.\*\*

### **Glaucoma**

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

### **Diabetic retinopathy**

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

## Fundamentals and Principles of Ophthalmology.

### The Lens.

1. Anterior epithelial monolayer, capsule, fiber cells compartment, zonules
2. Nuclear regions, cortex
3. Functions of the lens
  - a. Lacks blood and lymph vessels and nerves
  - b. Maintains lifelong transparency to visible light
  - c. Provides a refractive medium with high refractive index (RI)
  - d. Decreases optical aberrations (spherical and chromatic) of a thick lens (variable RI, yellow color)
  - e. Maintains focusing power for near vision (accommodation)
  - f. Allows metabolic survival of nuclear region of differentiated /mature fibers lacking intracellular organelles
  - g. Filters UV and blue light entering the eye to protect the vitreous and the retina.
4. Physiopathology of the lens:
  - a. Loss of accommodation (presbyopia)
  - b. Loss of transparency (cataracts)
5. Differentiation and growth of the lens
  - a. Elongation
  - b. Loss of intracellular organelles
6. Consequences of absence of intracellular organelles:
  - No DNA/protein synthesis (but GSH (glutathione) synthesis continues)
  - No mitochondrial highly energetic aerobic glycolysis
  - Only cytoplasmic anaerobic glycolysis (low energy yield) continues
  - b. - Proteins exposed for life to post synthetic modifications and photo-oxidative damage.
  - c. Compensatory mechanisms:
  - d. Fiber membranes enriched in gap junctions and aqueous pores to allow:

rapid diffusion of molecules (nutrients, waste)

- rapid dissipation of osmotic gradients
  - high degree of cell coupling (syncytium).
  - Physical basis of lens transparency
  - e. Absence of scattering/absorbing centers
  - f. Short-range order of crystallins
7. Aging changes of the lens
- a. "Yellowing"
    - Spontaneous glycosylation (Maillard reaction)
    - Spontaneous melanization (photooxidation of tyr and trp)
  - b. Aggregation + in-solubilization of proteins
  - c. Hardening (sclerosis)
  - d. Increase in acidic proteins
  - e. Fragmentation of primary structure
8. The light that reaches the lens: the lens is a protective blue filter for the vitreous and retina. Direct photochemical effect of UV light, Indirect photochemical effect of visible light (photosensitization)
9. The lens proteins:
- a.  $\alpha$ -crystallins:
  - b.  $\beta\gamma$ -crystallins
10. X-linking reactions
- a. Spontaneous Glycosylation (Maillard reaction)
  - b. Spontaneous Melanization (photo-oxidation of aromatic amino acids tyr and trp)
  - c. Lateral  $\epsilon$ - $\gamma$  peptide bond formation catalyzed by transglutaminase
  - d.  $\beta$ -Elimination reactions of Ser and Thr
  - e. Formation of protein disulfides and mixed disulfides.

## The Cornea.

### Layers-Function.

1. Epithelium (65 $\mu$ m thick, 5-10% of corneal thickness, 5-6 cell layers)
  - a. Squamous cells layer, wing cells layer, basal cell monolayer
  - b. Rich in tight junctions sealing intercellular spaces
2. Bowman's layer (8-12 $\mu$ m thick)
  - a. Random fibers type I and V collagen fibers, 30 nm diam in a matrix of proteoglycans and glycoproteins
  - b. Acellular, does not regenerate
  - c. Contributed by stromal keratocytes and epithelial cells during embryogenesis
  - d. Could prevent exposure of keratocytes to growth factors produced by the epithelial cells
3. Stroma (90% corneal thickness)
  - a. Keratocytes (10-40% age-dependent corneal volume,)
  - b. 200 layers collagen lamellae
  - c. Glycosaminoglycans (GAGs)
  - d. Matrix metalloproteinases (MMPs): Zn-dependent enzymes degrading components of extracellular matrix, MMP-2 proenzyme is normal, several other MMPs are synthesized after injury: MMP-1, MMP-3, MMP-9, etc
  - e. proteinase inhibitors ( $\alpha$ 1-proteinase inhibitor,  $\alpha$ 1-antichymotrypsin,  $\alpha$ 2-macroglobulin, plasminogen activator inhibitors 1 and 2, tissue inhibitors of metalloproteinases) restrict damage during corneal inflammation, ulceration, wound healing.
4. Descemet's membrane (10 $\mu$ m thick)
  - a. basement membrane of endothelial cells
  - b. type IV collagen, anterior banded layer, posterior non-banded layer
5. Endothelium
  - a. cell monolayer, "leaky" tight junctions
  - b. limited regeneration after birth, edema formed if enough cells are injured healing occurs mainly by cell migration, rearrangement and enlargement of the residual cells

- c. 3000 cells/mm<sup>2</sup> (young individuals), age-dependent decrease
  - d. apical tight junctions establish permeability barrier
  - e. Na/K pump maintains the stroma in a relative dehydrated state essential for transparency. Endothelial cell dysfunction leads to corneal edema and cloudiness.
6. Nerves and vessels
- a. Avascular, very rich afferent innervation
7. Physical basis of corneal transparency
8. Corneal permeability
- a. Epithelium creates barrier to hydrophilic molecules. Prodrugs
  - b. The Stroma creates barrier to hydrophobic substances
  - c. benzalkonium chloride
9. Resistance to oxidative damage due to high levels of aldehyde dehydrogenase (AD) and transketolase (TK) and HMP shunt active in epithelium and endothelium.
10. AD and TK represent up to 50% of the soluble proteins in corneal stroma, may contribute to corneal transparency

### The Aqueous Humor.

#### 1. Functions:

- a. Extracellular fluid with very low protein concentration (<12 mg%)
- b. Acellular high level of ascorbate relative to plasma (x50, actively transported at the ciliary body) may contribute. UV spectral protection to the eye of diurnal animals
- c. Contributes nutrients, metabolic substrates to avascular eye tissues: cornea, lens, vitreous, trabecular meshwork
- d. Provides route for metabolic waste elimination from avascular tissues
- e. Compositional reference to the design of tissue culture media for eye tissues
- f. Produced by secretion at the ciliary body (pigmented and non-pigmented cells) modified by interchange with adjacent tissues in its way out of the eye (irido-corneal angle)
- g. Composition is not uniform (ie, posterior vs anterior chamber)
- h. Diagnostic potential

#### 2. Composition.

- a. pH = 7.5-7.6, isoosmotic (in posterior chamber could be somewhat hypertonic)
- b. Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup> concentrations as in plasma
- c. Ca<sup>2+</sup> and PO<sub>4</sub><sup>3-</sup> are half those in plasma
- d. Cl<sup>-</sup> and HCO<sub>3</sub><sup>-</sup> can be above or below plasma, depending on the animal. Inverse relationship between Cl<sup>-</sup> and HCO<sub>3</sub><sup>-</sup> in some animals
- e. pO<sub>2</sub> average = 55 mmHg, derived from air (lids open), iris and ciliary body
- f. pCO<sub>2</sub> = 40-60 mmHg
- g. Glucose is from 76% to 63% of plasma concentration, increased in diabetes in proportion to plasma glucose; glucose enters aqueous humor by insulin-independent, facilitated diffusion.
- h. Urea 80-90% of plasma
- i. *Myo*-inositol, lactic acid higher than plasma
- j. Citrate as in plasma
- k. Amino acids: 0.1-3 ratios, relative to plasma

- l. Antioxidants: GSH 1-10  $\mu\text{M}$
  - m. Ascorbate 0.7-1.6 mM (diurnal animals)
  - n. Primary aqueous humor does not coagulate
  - o. Enzymes
  - p. Growth factors
  - q. Lipids and prostaglandins (PGs)
  - r. Hydrogen peroxide ( $<0.3 \mu\text{M}$ )
3. Characteristics
- a. Blood-aqueous barrier
  - b. non-fenestrated iris capillaries
  - c. Ciliary body epithelium (pigmented and non-pigmented cells)
  - d. NOTE: ciliary body capillaries are fenestrated
  - e. Ciliary body stroma “freely” communicated with anterior chamber
  - f. Secondary aqueous humor produced by rupture of the blood-aqueous barrier (trauma, paracentesis, mechanical injury, surgery, uveitis, stimulation of trigeminal nerve, bacterial endotoxins, drugs, radiations, chemical irritation, ...)
4. Secretion and IOP
5. Control of IOP
6. Due to the complex nature of the system that generates IOP, it is possible to modify the IOP at several levels and by different mechanisms:
- i. Secretion of aqueous humor
    1. Ciliary epithelium processes
      - a. Transfer ciliary stroma to pigmented cells
      - b. Transfer pigmented cell to non-pigmented cell
      - c. Transfer non-pigmented cell to posterior chamber
      - d. Na/K-ATPase
      - e. Carbonic anhydrase
    2. “Leaky” tight junctions between non-pigmented cells



3. Changes in blood flow
4. Passive osmotic changes
- ii. Resistance to outflow
  1. Direct effects on trabecular meshwork
  2. Indirect effects mediated by ciliary muscle contraction
- iii. Amount of blood inside the globe at a given moment
- iv. Pressure of extra-ocular venous blood vessels
7. Each of the neurotransmitters of the sympathetic and parasympathetic nervous systems may act simultaneously over several of the factors described above, leading to complex effects, in addition desensitization and hypersensitivity effects should also be considered, as well as vascular mediated effects (blood flow)
8. Typical examples of anti-glaucoma agents
  - a. **DECREASE AQUEOUS HUMOR SECRETION:**  $\beta$ -adrenergic antagonists
    - a.  $\alpha$ 2-adrenergic agonists
    - b. Carbonic anhydrase inhibitors
    - c. Na/K ATPase inhibitors (V)
    - d. Osmotic agents
  - b. **INCREASE TRABECULAR OUTFLOW:** miotics (PSmimetics)
    - a. Adrenergic agonists
    - b. Surgery
  - c. **INCREASE UVEOSCLERAL OUTFLOW:** prostaglandins analogues
    - a.  $\alpha$ -Adrenergic agonists

**The Tear Film.**

## 1. Functions

- a. Smooth optical surface at air/eye interface
- b. Remove debris
- c. Protect ocular surface
- d. Supply O<sub>2</sub>, substrates, growth factors, ... to corneal epithelium
- e. Provide antimicrobial agents to optical surface
- f. Lubricate corneal/eyelid interface
- g. Prevent tear overflow
- h. Prevent desiccation of ocular surface

## 2. Components

- a. Tear meniscus (upper and lower)
- b. Pre-ocular film, pre-corneal tear film
- c. Conjunctival sac

## 3. Pre-corneal tear film

- a. Anterior lipid layer                      0.1-0.2  $\mu\text{m}$ 
  - i. Inhibits evaporation
  - ii. Meibomian (tarsal) glands: PS( cholinesterase +) and S, VIP, NPY-                      positive; 30-40 in upper eye; 20-30 smaller in lower eyelid
  - iii. Sebaceous glands of Zeiss
- b. Middle aqueous layer
  - i. 8-9  $\mu\text{m}$  (3.4  $\mu\text{m}$  w/ new methods: OCT, reflectometry)
  - ii. main gland richly innervated by PS, less dense by S
  - iii. Glands of Krause (2/3 accessory lacrimal glands)
  - iv. Glands of Wolfring (1/3 accessory lacrimal glands)
  - v. Components

1. Electrolytes and water
  2. Other solutes: urea, glucose, ascorbate, ...
  3. Proteins: IgA, sIgA, IgE, lysozyme, lactoferrin, interferon, cytokines, growth factors, lipocalins, defensins...
- vi. Functions
1. Supply O<sub>2</sub> to avascular corneal epithelium
  2. Maintain constant electrolyte composition and pH (6.5-7.6)
  3. Antibacterial, antiviral
  4. Smooth micro-irregularities of anterior corneal surface
  5. Wash away debris
  6. Modulate cell functions of cornea and conjunctival epithelia
- c. Posterior mucin layer                      1 μm
- i. Convert hydrophobic corneal epithelium surface to hydrophilic surface
  - ii. Stabilize film by lowering surface tension of tear lipid
  - iii. Trap exfoliated surface cells, foreign particles, bacteria
  - iv. Conjunctival goblet cells (2μL/day), stratified squamous cells of conjunctival and corneal epithelia
  - v. Tear dysfunction may be the result of alterations in the tear mucins (defect, excess, modified)
4. Steady-state volume tears and secretory rate
- i. 7.4 μL (un-anaesthetized eye) Schirmer 3.8 μL/min  
Fluorophotometer 0.9 μl/min
  - ii. 2-6 μL (anaesthetized)
5. Tear secretion
- a. Old view, 2 components: basal secretion (accessory glands); reflex secretion (main gland)

- b. New view, all lacrimal glands respond as a unit, including cornea and conjunctival cells, with a mixture of mucin and other proteins, electrolytes and water
  - c. Reflex (neural) tear secretion induced by physical irritation, psychogenic factors and bright light includes two signaling pathways:
    - i.  $\text{Ca}^{+2}$ /protein kinase C-dependent via activation of phospholipase-C triggered by ACH (muscarinic receptors) and NE ( $\alpha$ -adrenergic receptors, except in the main gland)
    - ii. c-AMP-dependent, triggered by VIP and NE ( $\beta$ -adrenergic receptors)
      - 1. Peptide hormones  $\alpha$ -MSH, ACTH (main gland, activate cAMP-dependent signaling pathway)
      - 2. steroidal hormones (androgens, activate secretion of sIgA in main gland and lipids of Meibomian glands.
6. Mechanical help from eyelid movements to tear flow/redistribution/drainage
7. Tear dysfunction
- a. - Change in the amount/composition of tear-film constituents (salts, water, mucin, lipids, ...)
    - Uneven dispersion of tear film because of corneal surface defects (inflammation, scarring, poor contact lens fit...)
    - Eyelid/globe incongruity (congenital, traumatic, neurogenic, ...)
  - b. KCS (dry eye): increasing evidence of association with ocular surface inflammation
  - c. Diagnostic tests
    - i. Tear breakup time
    - ii. Lissamine green staining
    - iii. Rose bengal staining
    - iv. Osmolarity tests
    - v. Schirmer tests.

## Optics and Refraction

### Overall goals

1. To understand the principles, concepts and methods described below and apply them in clinical practice.
2. To identify the principles and technique of retinoscopy and perform an integrated refraction based upon retinoscopic results.

### Basic Level Goals YEAR 1

#### A. Cognitive skills goals

1. Physical Optics
  - a) Properties of light
  - b) Diffraction
  - c) Scattering
  - d) Lasers
  - e) Image quality
  - f) Light propagation
2. Geometric Optics
  - a) Reflection
  - b) Refraction
  - c) Prisms
  - d) Spherical lenses
  - e) Astigmatic lenses
  - f) Notation of lenses
  - g) Aberrations of lenses
3. Clinical Optics
  - a) Optics of the eye
  - b) Transmittance of light by optic media
  - c) Effect of pupil on resolution of optical system
  - d) Visual acuity
  - e) Emmetropia
  - f) Ammetropia
  - g) Refractive errors
  - h) Accommodation and its problems
  - i) Pinhole
  - j) Correction of ammetropia
  - k) Purkinje shift

#### B. Technical skills goals

1. The resident should be able to perform retinoscopy for detecting simple refractive errors
2. The resident should be able to use a phoropter for simple refractive errors.
3. The resident should be able to perform subjective refraction for simple refractive errors
4. The resident should be able to use perform direct and indirect ophthalmoscopy
5. The resident should be able to use a lensometer
6. The resident should be able to use a slit lamp and applanation tonometry
7. The resident should know the lenses used for fundus biomicroscopy.

**Standard Level Goals: YEAR 2****A. Cognitive skills goals**

1. Improve proficiency in Basic level skills
2. Problems of spectacles in aphakia
3. Affect of spectacles and contact lens correction on accommodation and convergence
4. Effective power of lens
5. Back vertex distance
6. Spectacle magnification
7. Calculation of IOL power
8. Presbyopia

**B. Technical skills goals**

1. The resident should be able to perform cycloplegic refraction
2. The resident should be able to prescribe glasses for children
3. The resident should understand and utilize the operating microscope.
4. The resident should be able to perform more complex refractions (post keratoplasty, post cataract extraction)
5. The resident should be able to use more advanced techniques using the phoropter for complex refractive errors(irregular astigmatism, vertex distance)
6. The resident should know how to use the keratometer for detection of more advanced refractive errors.

**Advanced Level Goals: YEAR 3****A. Cognitive skills goals**

1. To apply the highest level of understanding of relevant optic information in the following situations:
  - a. In prescribing spectacles and contact lenses
  - b. Intraocular lens calculation
  - c. Cataract surgery
  - d. Use of prisms for diplopia

**B. Technical skills goals**

1. The resident should be able to perform corneal topographic measurements
2. The resident should be able to perform keratometry
3. The resident should be able to perform most advanced refraction techniques( pre and post refractive surgery)

**Lectures scheduled to cover above competencies.**

1. Physical Optics
2. Geometric Optics
3. Refraction
4. Prisms

5. Spherical Lenses
6. Ammetropia
7. Accommodation
8. Magnification
9. Instruments and tests
10. Prescribing glasses/low vision refraction

**Completion of these objectives will be measured by:**

1. OKAP
2. OCEX
3. Journal Club evaluations.
4. Case presentations.

## Cataract and Lens.

### Overall goals

1. To describe the evaluation and management, indications for, and intra and post-operative complications of cataract and anterior segment surgery.
2. Perform complete pre-operative evaluation of cataract patients, including normal and pathological lens changes.
3. Perform evaluation and management of cataract patients in ethical manner.
4. Understanding and interpretation of biometry principles.
5. Perform routine and advanced cataract surgery and intraocular lens implant.
6. Understanding of refractive surgery options associated with pre- and post-cataract surgery.

### YEAR 1

#### A. Cognitive skills goals

1. Common causes and types of cataracts:
  - a. Senile, ocular, traumatic, or associated with systemic illness
2. Basic history, exam, and refraction (and basic optics) of cataract patient.
3. Identify steps in different cataract surgery techniques:
  - a. Intracapsular
  - b. Extracapsular
  - c. Phacoemulsification
4. Identify IOL's:
  - a. Types
  - b. Indications
  - c. Calculation
5. Familiar with evaluation instruments as: lensometer, autorefractor, retinoscope, phoropter, keratometer, slit lamp, glare and contrast evaluation tools, and potential acuity meter.

#### B. Technical skills goals

1. The resident should be able to perform biomicroscopy, retinoscopy, refraction and ophthalmoscopy (direct and indirect) pre- and post-cataract surgery patients.
2. Classify types of lens opacities
3. Describe and perform basic steps of cataract surgery in wet lab, including:
  - a. Wound description
  - b. Capsulotomy/capsulorrhexis
  - c. Viscoelastic use
  - d. ECCE and phaco techniques
  - e. IOL insertion
4. Perform patient preparation and draping, anesthesia, and assist in cataract surgeries



**YEAR 2****A. Cognitive skills goals**

1. Describe uncommon causes and types of cataracts.
2. Preoperative assessment, history, exam, and refraction of cataract patient, including:
  - a. Systemic diseases
  - b. Peri-ocular and ocular diseases relevance to cataracts.
  - c. Correlation of cataract type/severity with visual and non-visual complaints.
3. Use and interpretation for A and B scan ultrasonography.
4. Identify indications, techniques, and complications of different anesthesia and cataract surgery techniques.
5. Familiar with surgical instruments and machines, as well as troubleshooting them.
6. Indications for, principles of, and techniques of YAG laser capsulotomy.

**B. Technical skills goals**

1. Use and interpretation for A and B Scan ultrasonography for calculation of IOL power.
2. Use and interpretation for optical coherence interferometry for calculation of IOL power.
3. Perform local injections (peri-, extra-, and intra-ocular).
4. Familiar with operating microscope use.
5. Perform basic extracapsular surgery and introduction to phacoemulsification in wet lab, then in operating room.
6. Perform paracentesis.
7. To recognize and treat/refer common post-operative complications of cataract surgery.

**YEAR 3****A. Cognitive skills goals**

1. Describe special/complex types of cataracts.
  - a. Performance.
  - b. Manage intra- and post surgical complications.
  - c. Special surgical method indications.
  - d. Indication for foldable vs. non-foldable IOL's
  - e. IOL reposition, removal, and exchange
2. Preoperative assessment, history, exam, and refraction of cataract patient within context of other subspecialties:
  - a. Combined cataract and glaucoma procedures.
  - b. Surgery post glaucoma, cornea, refractive, retina, plastic, or trauma procedures.
  - c. Uveitis patients.
- 3 Special procedures
  - a. Secondary and special IOL's.
  - b. Capsular tension rings, capsule tints, etc.
3. Evaluate and manage intra- and post-surgical complications.
  - a. Endophthalmitis management.

4. Identify indications, techniques, and complications of different anesthesia and cataract surgery techniques.
5. Familiar with surgical instruments and machines, as well as troubleshooting them.
6. Indications for, principles of, and techniques of YAG laser capsulotomy.

### **B. Technical skills goals**

1. Use and interpretation for A and B scan ultrasonography for calculation of IOL power.
2. Use and interpretation for optical coherence interferometry for calculation of IOL power
3. Perform complete phacoemulsification with IOL implant in wet lab, then in operating room.
4. Perform cataract surgery and related procedures in special/complex cases.
5. Evaluate and manage intra- and post-surgical (including late onset) complications.
6. Evaluation and management of post-operative residual refractive errors, including non-surgical and surgical correction.
7. Evaluation and management of astigmatism during cataract surgery.

#### **Above objectives will be covered by:**

- I. The following lectures given once during the Basic Course at twice during the rest of the 36 months of training
  - a. Lens basics (Anatomy, physiology, embryology, pathology). Cataract evaluation. Pediatric vs. adult.
  - b. Cataract surgery
  - c. Management of cataracts and special situations. Cataract complications.
  - d. Biometry, IOL's, refractive surgery associated with cataract patients.
- II. Interaction between faculty and resident during General Clinics.
- III. Journal club sessions.
- IV. Review of the HSRC.
- V. Case presentations.
- VI. Discussion of complicated cases.

#### **Completion of these objectives will be measured by:**

1. Direct surgical supervision (ORSSA).
2. OKAP.
3. OCEX.
4. OCAT.
5. Journal Club evaluations.
6. Case presentations.

## Glaucoma.

### YEAR 1.

#### A. Cognitive Skills.

1. For POAG describe.
  - a. Epidemiology.
  - b. Genetics.
  - c. Anatomy of the anterior segment.
  - d. Anatomy of the retina, optic nerve and RNFL.
  - e. Physiology of aqueous humor.
  - f. Patient evaluation.
    - i. External exam and its impact for the glaucoma patient.
    - ii. Basic tonometry, impact of corneal thickness.
      1. Understand principle of tonography.
    - iii. Slit lamp examination.
      1. Gonioscopy.
        - a. Techniques.
        - b. Normal anatomy.
        - c. Pathology.
    - iv. Perimetry including kinetic and static perimetry.
    - v. Optic nerve and RNFL imaging.
  - g. Principles of medical management.
    - i. Medical strategies.
    - ii. Concept of MMT.
    - iii. Side effects.
    - iv. Impact of major clinical studies in the algorithm of medical therapy.
    - v. Alternatives to medical therapy.
2. Describe features of PACG, Normal Tension Glaucoma and Secondary Glaucoma.
3. Understand principles of post-op medical care in cataract surgery in the patient with glaucoma.
4. Understand principles of post-op medical care for glaucoma and combined cataract and glaucoma surgery.
  - a. Recognize hypotony.
    - i. Presence or absence of leakage.
    - ii. Choroidal effusion.
  - b. Recognize and understand aqueous misdirection.

#### B. Technical and Surgical Skills.

1. Perform:
  - a. Goldmann tonometry.
  - b. Gonioscopy.
    - i. Three and four mirror.
  - c. Stereo exam of the optic nerve with 90 diopter lens or equivalent.
  - d. Corneal pachymetry.

- i. Understand its significance.
- e. Perimetry.
  - i. Confrontation fields.
  - ii. Goldmann perimetry.
  - iii. Automated Perimetry.

**Above objectives will be covered by:**

1. The following lectures given once during the Basic Course at twice during the rest of the 36 months of training.
  - a. Basic eye exam for glaucoma patients: tonometry, gonioscopy, ophthalmoscopy, biomicroscopy and corneal pachymetry.
  - b. Intraocular pressure; Anatomy, physiology and measurement.
  - c. Understanding POAG, POAG suspect and PACG.
    - i. Impact of evidence based medicine in Glaucoma Therapy.
      1. Major glaucoma studies.
  - d. Visual Fields.
  - e. Optic nerve, RNFL anatomy, physiology, pathophysiology and imaging studies.
  - f. NTG.
  - g. Secondary Glaucoma.
    - i. PXS, Pigmentary Glaucoma and elevated Episcleral Pressure.
    - ii. Angle recession, Hyphema, Steroid induced and post-surgery.
  - h. Infantile and Juvenile Glaucoma.
    - i. Medical therapy in Glaucoma.
    - j. Post-op care in glaucoma.
2. Interaction between faculty and resident during General and Glaucoma clinics.
3. Journal club sessions.
4. Review of the HSRC.
5. Case presentations.
6. Discussion of complicated cases.
7. Clinical-Pathologic correlation.

**Completion of these objectives will be measured by:**

1. OKAP.
2. OCEX.
3. Journal Club evaluations.
4. Case presentations.

**YEAR 2.**

**A. Cognitive Skills.**

1. Describe and recognize for moderate and severe POAG, Secondary Glaucoma and NTG.
  - a. Other tonometry techniques.
  - b. Diurnal curve
  - c. Impact of CCT.

- d. Moderate to severe optic nerve and visual field changes.
  - i. Role of complex visual field strategies.
    1. SITA.
    2. FDT.
    3. SWAP
  - ii. Signs of progression.
2. Role of gonioscopy in complex forms of PACG and Secondary Glaucoma.
3. Describe the features of infantile and secondary glaucoma.
  - a. Understand the arrest in development of the TM.
4. Describe the principles of medical management for moderate to severe.
  - a. POAG.
  - b. PACG.
  - c. NTG.
  - d. Secondary Glaucoma.
  - e. For above conditions understand.
    - i. Concept of MMT.
    - ii. Side effects of medications.
    - iii. Be aware of potential new medications, as well as alternative routes of administration.
    - iv. Impact of major clinical studies in the algorithm of medical therapy.
    - v. Alternatives to medical therapy.
5. Describe principles of laser therapy in Glaucoma.
  - a. Indications.
  - b. Parameters.
  - c. Techniques.
  - d. Complications.
  - e. Post-op care.
6. Describe the surgical therapy in glaucoma.
  - a. Indications.
  - b. Techniques.
  - c. Complications.
  - d. Post-op care

## B. Technical and Surgical Skills.

1. Perform:
  - a. Nd: YAG laser capsulotomy.
  - b. Laser Iridotomy.
  - c. Laser trabeculoplasty.
  - d. Describe and manage shallow/ flat anterior chamber

### Above objectives will be covered by:

1. The following lectures given once during the Basic Course at twice during the rest of the 36 months of training.
  - a. Understanding POAG, POAG suspect and PACG.
    - i. Impact of evidence based medicine in Glaucoma Therapy.

1. Major glaucoma studies.
2. Visual Fields.
- b. Optic nerve, RNFL anatomy, physiology, pathophysiology and imaging studies.
- c. NTG.
- d. Secondary Glaucoma.
  - i. PXS, Pigmentary Glaucoma and elevated Episcleral Pressure.
  - ii. Angle recession, Hyphema, Steroid induced and post-surgery
- e. Infantile and Juvenile Glaucoma.
- f. Medical therapy in Glaucoma.
- g. Anterior Segment Laser Surgery.
- h. Post-op care in glaucoma.
2. Interaction between faculty and resident during General and Glaucoma clinics.
3. Journal club sessions.
4. Review of the HSRC.
5. Case presentations.
6. Discussion of complicated cases.
7. Clinical-Pathologic correlation.

Completion of these objectives will be measured by:

1. OKAP.
2. OCEX.
3. OCAT.
4. ORSSA
5. Resident's Portfolio.
6. Journal Club evaluations.
7. Case presentations.

### YEAR 3

#### A. Cognitive Skills.

1. Describe and understand most complex forms of POAG, NTG, PACG, Secondary Glaucoma and Infantile-Juvenile Glaucoma.
2. Understand the role in complex forms of glaucoma.
  - a. Mechanics of aqueous humor.
  - b. Impact and prognostic value of CCT.
  - c. Diurnal curve.
  - d. Gonioscopy.
  - e. Interpret complex strategies of SAP.
  - f. Assessment of the optic nerve/RNFL.
    - a. Stereo view.
    - b. Imaging studies: OCT, HRT and GDx
    - c. Describe, recognize and treat with medical, laser or surgical therapy all forms of moderate to severe glaucoma.
  - g. Utilize the concept of evidence-based medicine to support the best therapy in all forms of glaucoma as delineated by all major clinical studies of glaucoma.

- a. Describe, recognize and treat infantile/juvenile glaucoma.
- b. Describe all forms of advanced surgical strategies for glaucoma.

#### B. Technical and Surgical Skills.

1. Perform all anterior segment laser procedures in patients with moderate to severe adult glaucoma (all types).
2. Perform laser cyclophotocoagulation.
3. Perform routine and secondary filtering surgery, with or without anti-metabolites.
4. Perform aqueous shunt procedures.
5. Recognize the importance of the evolving field of MICS, be adapting to these techniques.
6. Treat all minor and major complications of glaucoma surgery.

#### Above objectives will be covered by:

1. The following lectures given once during the Basic Course at twice during the rest of the 36 months of training.
  - a. Understanding POAG, POAG suspect and PACG.
    - i. Impact of evidence based medicine in Glaucoma Therapy.
      - a. Major glaucoma clinical studies.
        - i. OHTS
        - ii. CIGTS.
        - iii. EMGT.
        - iv. AGIS.
        - v. CNTG.
        - vi. GLT.
        - vii. GLTS.
        - viii. 5FU.
        - ix. TVT
  - b. Visual Fields.
  - c. Optic nerve and RNFL.
  - d. NTG.
  - e. Secondary Glaucoma.
  - f. Medical therapy in Glaucoma.
  - g. Anterior Segment Laser Surgery.
  - h. Incisional filtering surgery for glaucoma, combine surgery and anti-metabolism use.
    - i. Tube-shunt surgery and new surgical ideas for glaucoma.
    - j. Post-operative glaucoma surgery treatment and complications
  - k. Infantile and Juvenile Glaucoma.
2. Interaction between faculty and resident during General and Glaucoma clinics.
3. Journal club sessions.
4. Review of the HSRC.
5. Case presentations.
6. Discussion of complicated cases.
7. Clinical-Pathologic correlation.

Completion of these objectives will be measured by:

1. OKAP.
2. OCEX.
3. OCAT.
4. ORSSA
5. Portfolio.
6. Journal Club evaluations.
7. Case presentations.



## Neuro-Ophthalmology

We have designed a Neuro-Ophthalmology curriculum based on the Principles and Guidelines of a Curriculum for Education of the Ophthalmic Specialist, as presented by the International Task Force on Resident and Specialist Education in Ophthalmology.

Cognitive, Technical and Surgical skills will be acquired by the resident by:

- a. Independent Study
- b. Conferences
- c. Journal Clubs.
- d. Case presentations
- e. Discussion of complicated cases.
- f. Direct interaction in clinic and OR.

The resident's acquisition of knowledge will be assessed by:

- a. OKAP scores
- b. Comprehension quizzes.
- c. OCEX.
- d. Journal Club evaluations.
- e. Case presentations evaluations.
- f. Direct observation and assessment in clinic and OR

### Basic (YEAR 1) and Standard Level Goals (YEAR 2)

The acquisition of knowledge compliant with Basic and Standard Level goals will be achieved by independent study, and didactic conferences. These conferences will be given in a cycle every 18 months, so every resident will cover the material twice during their residency. Outlined below are the conference topics with the minimal requisite areas to be covered.

1. The Neuro-Ophthalmic examination. At the end of the conference the resident should be able to:

A complete Neuro-Ophthalmic examination will be discussed, including but not limited to:

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).

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.

Perform basic direct, indirect, and magnified ophthalmoscopic examination of the optic disc (e.g., recognize optic disc swelling, optic atrophy, neuroretinitis).

Describe the indications for and interpret basic echography of orbits.

And the following Standard Level Goals:

Perform a detailed cranial nerve evaluation (e.g., testing of oculomotor, trochlear, trigeminal, and facial nerve function).

Describe the evaluation, management, and specific testing (e.g., stereopsis, mirror test, red-green testing) of patients with <sup>a</sup>functional<sup>o</sup> (non-organic) visual loss (e.g., recognize

non-organic spiral or tunnel visual fields).

2. Neuro anatomy of the visual pathways and ischemic optic neuropathies.

Will cover the following Basic and Standard level goals:

Describe the neuro-anatomy of the visual pathways.

Describe the typical and atypical features, evaluation, and management of ischemic optic neuropathy [arteritic and non-arteritic]

Describe the indications for, perform, and list the complications of temporal artery biopsy.

3. Optic Neuritis, Neuro-retinitis and Inflammatory Optic Neuropathies

Describe typical and atypical features, evaluation, and management of optic neuritis, neuro-retinitis and inflammatory optic neuropathy

#### 4. Optic Neuropathies

Will cover the following Basic and Standard Level goals:

Describe typical and atypical features, evaluation, and management of toxic or nutritional optic neuropathy, ethambutol toxicity, and compressive, infiltrative, infectious and traumatic optic neuropathies).

Describe typical features of inherited neuro-ophthalmologic diseases (e.g., Leber's hereditary optic neuropathy, autosomal dominant optic atrophy, spinocerebellar degenerations).

#### 5. Congenital Optic Nerve Anomalies

Will cover the following Basic Level goals:

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).

#### 6. Motility and Strabismus I

Will cover the following Basic Level goals:

Describe the neuro-anatomy of the cranial nerves.

Describe ocular motility and related neuronal pathways.

Describe the typical features, evaluation, and management of the most common ocular motor neuropathies (e.g., third, fourth, sixth nerve palsy).

Describe the typical features of cavernous sinus and superior orbital fissure syndromes (e.g., infectious, vascular, neoplastic, inflammatory etiologies).

Perform a detailed cranial nerve evaluation (e.g., testing of oculomotor, trochlear, trigeminal, and facial nerve function).

#### 7. Motility and Strabismus II

Will cover the following Basic and Standard Level goals:

Describe the clinical features, evaluation, and management of ocular myasthenia gravis.

Recognize, evaluate, and treat ocular myasthenia gravis.

Describe the indications for, administer, and interpret the results of intravenous edrophonium (Tensilon) and Prostigmin tests for myasthenia gravis.

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).

## 8. Nystagmus

Will cover the following Basic and Standard Level goals:

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).

Describe typical and atypical features, evaluation, and management of the more complex and less common forms of nystagmus (e.g., rebound, convergence, retraction).

## 9. Pupillary Disorders

**Will cover the following Basic and Standard Level goals**

Describe the pupillary and accommodative neuro-anatomy.

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).

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, <sup>a</sup>physiologic<sup>o</sup> 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, tonic pupil).

Describe typical and atypical features, evaluation, and management of the more complex and less common pupillary abnormalities (e.g., light-near dissociation, pharmacologic miosis).

## 10. Visual Field Examination

At the end of the conference, the resident should be able to:

Describe the typical features, evaluation, and management of the most common visual field defects (e.g., optic nerve, optic chiasm, optic radiation, occipital cortex).

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.

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).

Describe more advanced aspects of visual field indications, selection, and interpretation (e.g., artifacts of automated perimetry, testing and thresholding strategies).

#### 11. Neuro-Radiology for the Ophthalmologist

At the end of this conference the resident should be able to:

Describe the anatomy and indications for, order appropriately, and interpret basic radiology studies of the brain and orbits, demonstrating the ability to communicate with radiologists in order to maximize both choice of proper diagnostic test and accuracy of interpretation.

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).

#### 12. Neuro-Ophthalmic manifestations of systemic disease/Orbital Vascular disease

At the end of this conference the resident should be able to:

Describe neuro-ophthalmic aspects of common systemic diseases (e.g., hypertension, diabetes, thyroid disease, myasthenia gravis, temporal arteritis, systemic infections and inflammation).

Describe the clinical features, evaluation, and management of carotid-cavernous fistula.

#### 13. Evaluation and management of non-organic visual loss.

At the end of this conference the resident should be able to:

Describe the evaluation, management, and specific testing (e.g., stereopsis, mirror test, red-green testing) of patients with <sup>a</sup>functional<sup>o</sup> (non-organic) visual loss (e.g., recognize

non-organic spiral or tunnel visual fields).

#### 14. Disorders of increased intracranial pressure.

In addition, residents are responsible for self study from AAO Basic Science Course and other references.

**Advanced Level Goals (YEAR 3)**

Acquisition of knowledge and skills compliant with advanced level goals will be evaluated mainly through direct interaction with the resident during their YEAR 3 Neuro-Ophthalmology rotation. During this rotation the resident should meet all basic and standard level cognitive and technical skills. Additionally the resident should engage in supplemental reading to meet the Advanced cognitive and technical skills outlined below, and be able to discuss the material in clinic. An evaluation at the end of this rotation will assess the resident's grasp of the material.

**A. 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).
4. Describe typical and atypical features, evaluation, and management of the most advanced and least common pupillary abnormalities (e.g., pupil findings in coma, transient pupillary phenomenon).
5. Describe typical and atypical features, evaluation, and management of the most complex and least common visual field defects (e.g., combination or bilateral lesions, cortical visual impairment).
6. Describe the most advanced aspects of visual field indications, selection, and interpretation (e.g., variability in automated perimetry, application of specific testing and thresholding strategies for different patient populations with different neuro-ophthalmic conditions, different testing abilities (e.g., young or old age, mental status, hand-eye coordination, reaction time)).
7. Describe, evaluate, and treat the neuro-ophthalmic aspects of systemic diseases (e.g., malignant hypertension, diabetic papillopathy, toxicity of systemic medications, pseudotumor cerebri).
8. Describe, evaluate, and treat the neuro-ophthalmologic manifestations of trauma (e.g., corticosteroid or surgical therapy in traumatic optic neuropathy).
9. Describe, evaluate, and provide appropriate genetic counseling for neuro-ophthalmologic diseases (e.g., Leber's hereditary optic neuropathy, chronic progressive external ophthalmoplegia, von Hippel-Lindau syndrome).

10. Recognize, evaluate, and treat (or refer) more complex forms of nystagmus.
11. Recognize, evaluate, and treat (or refer) transient monocular or binocular visual loss.

**B. Technical/Surgical Skills**

1. Perform and interpret the results of the intravenous edrophonium (Tensilon) and prostigmine tests for myasthenia gravis, and recognize and treat the complications of the procedures.
2. Perform and interpret the complete cranial nerve evaluation and basic neurologic examination in the context of neuro-ophthalmic localization and diseases.
3. Interpret neuro-radiologic images in neuro-ophthalmology (e.g., interpretation of orbital imaging for orbital pseudotumor and tumors, thyroid eye disease, intracranial imaging modalities and strategies for tumors, aneurysms, infection, inflammation, and ischemia), and appropriately discuss, in advance of testing, the localizing clinico-radiologic features with the neuroradiologist in order to obtain the best study and interpretation of the results.
4. Recognize patients with functional visual loss (non-organic visual loss) and provide appropriate counseling and follow-up.
5. Describe indications, dose, and administration of Botox for neuro-ophthalmic disorders (eg, hemifacial spasm, blepharospasm, paralytic strabismus).

## Ophthalmic Histopathology.

### YEAR 1.

#### A. Cognitive Skills.

1. Describe basic ocular anatomy and identify the histology of the major structures of the eye.
2. Describe basic histopathology and pathophysiology of most common diseases of the eye.
3. Identify the histopathology of important intraocular and adnexal diseases.
  - a. Endophthalmitis.
  - b. Uveitis.
  - c. Infectious and non-infectious keratitis.
  - d. Periocular and intraocular tumors.

#### B. Technical Skills.

1. Describe the steps for handling and processing gross specimens of ocular pathology.
2. Describe the information necessary for an effective communication with the pathologist regarding special handling of specimens for special stains or studies.
3. Describe the indications for frozen sections.
  - a. Exam and cut whole globes.
  - b. Participate under supervision in the microscopic ophthalmic examination of specimens from active cases.

### YEAR 2.

#### A. Cognitive Skills.

1. Describe advanced ocular anatomy and identify the histology of major and minor eye's structures.
2. Describe advanced pathophysiology of eye's diseases and identify their major histologic findings.
3. Identify histology of less common but potential vision or life threatening intraocular and adnexal conditions. These include but is not limited to:
  - a. Temporal Arteritis.
  - b. Fungal Endophthalmitis.
  - c. Extraocular spread of intraocular tumors.
  - d. Metastatic disease to the eye.
4. Describe advanced techniques of ocular pathology.
  - a. Electron Microscopy.
  - b. Cytology.
  - c. Immunohistochemistry.
  - d. Tumor free margins.



**B. Technical Skills.**

1. Describe appropriate steps in the more advanced handling and special processing of gross specimens.
  - a. Understand as well as be able to communicate to the pathologist the specific indications for special handling of specimens for special stains or studies
  - b. Understand the indications as well as be able to perform and prepare a biopsy for frozen sections.
2. Prepare a basic histology specimen.
3. Participate as an observer during microscopic examination of active ophthalmologic cases.
  - a. Perform microscopic examination with and without supervision.

**YEAR 3.****A. Cognitive Skills.**

1. Identify less common normal variants of ocular anatomy and histology.
2. Identify less common and more complex pathophysiologic processes and their histology counterpart.
3. Identify histology of the least common but potential vision or life threatening intraocular and adnexal conditions.
  - a. Healed Giant Cell Arteritis.
  - b. Masqueraders of inflammation or neoplasms.
  - c. Uncommon benign or malignant neoplasms.

**B. Technical Skills.**

1. Describe appropriate steps in the more advanced handling and special processing of gross specimens.
2. Perform pre-operative, intra-operative and post-operative consultations with the pathologist regarding specific indications for special stains or processing.
3. Interpret the pathologic report of frozen sections.
4. Participate as an observer during microscopic examination of active ophthalmologic cases.
  - a. Perform microscopic examination with and without supervision.

**The above objectives will be achieved through**

1. A series of lectures to be given during the Basic Science Course and repeated twice during the 36 months of residency training.
  - a. Ocular Inflammation.
  - b. Non-granulomatous and granulomatous ocular inflammation.
  - c. External eye anatomy and pathology.
  - d. Diabetes Mellitus.
  - e. Childhood Tumors.
    - i. Retinoblastoma.

- ii. Pseudoglyoma.
    - iii. Phacomatosis.
    - iv. Other benign and malignant childhood tumors.
  - f. Orbit anatomy and pathology.
  - g. Anatomy and Pathology of the Anterior Segment.
  - h. Pathophysiology of Glaucoma.
  - i. Anatomy and Pathology of the Lens.
  - j. Anatomy and Pathology of the Posterior Segment.
  - k. Retinal and Uveal Tumors.
    - i. Melanomas.
    - ii. Metastatic disease to the eye.
- 2. Journal club sessions
- 3. Review of the HSRC
- 4. Case presentations in Grand Rounds
- 5. Clinical-Pathologic Correlation.

**D. Completion of the objectives will be measured by**

- 1. OKAP.
- 2. Portfolio.

## Oculoplastic Surgery and Orbits.

### YEAR 1

#### A. Cognitive Skills

1. To describe the basic eyelid, lacrimal, and orbital anatomy and physiology.
2. To describe the basic mechanisms and indications for treatment of eyelid, orbital and lacrimal trauma.
3. To describe the epidemiology, clinical features, evaluation, and management of common eyelid disorders.
  - a. Ptosis
  - b. Entropion
  - c. Ectropion
  - d. Retraction
  - e. Floppy Eyelid Syndrome
  - f. Trichiasis
  - g. Blepharospasm and hemifacial spasm
4. To describe the epidemiology, clinical features, evaluation, and management of common orbital disorders in adults and children.
  - a. Differential diagnosis of proptosis
  - b. Orbital cellulitis
5. To describe the epidemiology, clinical features, evaluation, and management of common lacrimal disorders in adults and children.
6. To perform pre-operative and post-operative assessment of patients with common oculoplastic disorders.
7. To describe techniques and complications of minor operating room procedures.
  - a. Incision and drainage of chalazia.
  - b. Excision of eyelid lesions.

#### B. Technical/Surgical Skills

1. To describe the indications for and to perform basic office examination techniques of the ocular adnexa, lacrimal system, and orbit.
  - a. Ocular adnexa
    - i. Eyelid eversion/double eyelid eversion.
    - ii. Margin to reflex distance one and two
    - iii. Eyelid crease
    - iv. Levator function
    - v. Eyebrow position.
  - b. Lacrimal system
    - i. Dye testing

- ii. Punctal dilation
  - iii. Canalicular probing
  - iv. Lacrimal irrigation
- c. Orbit
  - i. Hertel Exophthalmometry
  - ii. Inspection
  - iii. Resistance to palpation
  - iv. Auscultation
- 2. To perform minor eyelid procedures.
  - a. Incision and drainage of chalazia.
  - b. Excision of small eyelid lesions.
  - c. Insertion and removal of punctal plugs.
  - d. Treatment of trichiasis.
- 3. To perform enucleation or evisceration under supervision.

**C. The above objectives will be achieved through**

1. A series of lectures to be given during the Basic Science Course and repeated twice during the 36 months of residency training.
  - a. Eyelid Anatomy and Physiology
  - b. Orbital and Lacrimal Anatomy and Physiology
  - c. Evaluation of Eyelid and Orbital Disorders
  - d. Congenital Eyelid and Orbital Abnormalities
  - e. Orbital Disorders
    - i. Infectious
    - ii. Inflammatory
    - iii. Orbital Neoplasms
  - f. Anophthalmic Socket
  - g. Eyelid Disorders
    - i. Ptosis
    - ii. Dermatochalasis
    - iii. Entropion/Ectropion
    - iv. Floppy Eyelid syndrome
    - v. Trichiasis
    - vi. Blepharospasm and Hemifacial Spasm
    - vii. Eyelid Neoplasms
  - h. Lacrimal Disorders
    - i. Evaluation and Management of Epiphora
    - ii. Lacrimal gland neoplasms
  - i. Eyelid and Orbital Trauma
  - j. Eyelid and Orbital Surgery
2. Oculoplastics and General Ophthalmology Clinic
3. Journal club sessions
4. Review of the HSRC
5. Case presentations in Grand Rounds

## 6. Clinical-Pathologic Correlation

**D. Completion of the objectives will be measured by**

1. OKAP
2. OCEX

**YEAR 2****A. Cognitive Skills**

1. To describe the advanced eyelid, lacrimal, and orbital anatomy and physiology.
2. To describe the genetics, clinical features, evaluation, and treatment of congenital eyelid and orbital disorders.
3. To describe the genetics, clinical features, evaluation, and treatment of craniosynostoses and other congenital malformations.
4. To describe the epidemiology, clinical features, evaluation, and management of more complicated eyelid disorders.
5. To describe the epidemiology, clinical features, evaluation, and management of more complicated orbital disorders in adults and children
  - a. Thyroid related orbitopathy (epidemiology, signs and symptoms, DDx, imaging, medical and surgical management).
  - b. Orbital inflammatory pseudo tumor (signs and symptoms, DDx, imaging, medical and surgical management).
6. To describe the epidemiology, clinical features, evaluation, and management of more complicated lacrimal disorders in adults and children (nasolacrimal duct obstruction, canaliculitis, dacryocystitis, dacryoadenitis).
7. To perform pre-operative and post-operative assessment of patients with simple and more complicated oculoplastic disorders.
8. To describe the mechanisms and indications for treatment of more complicated eyelid, orbital and lacrimal trauma.

**B. Technical/Surgical Skills**

1. To describe indications for and perform more advanced examination techniques for less common eyelid, brow, lacrimal, and orbital abnormalities.
  - a. Measurement of hypoglobus, facial asymmetry, brow ptosis
  - b. Interpretation of dye testing
  - c. Orbital ultrasound interpretation
2. To identify common orbital pathology on Ultrasound, CT and MRI studies of the orbit
  - a. Orbital fractures
  - b. Orbital tumors
3. To perform more complicated minor operating room procedures
  - a. Larger benign skin lesions

- b. Recurrent or larger chalazia

**C. The above objectives will be achieved through**

1. A series of lectures to be given during the Basic Science Course and repeated twice during the 36 months of residency training (See lecture schedule above)
2. Oculoplastics and General Ophthalmology Clinic
3. Journal club sessions
4. Review of the HSRC
5. Case presentations in Grand Rounds
6. Clinical-Pathologic Correlation

**D. Completion of the objectives will be measured by**

1. OKAP
2. OCEX
3. OCAT
4. ORSSA
5. Portfolio

### YEAR 3

**A. Cognitive Skills**

1. To describe advanced eyelid, lacrimal, and orbital anatomy and physiology
2. To evaluate and treat simple to advanced eyelid, orbital, and lacrimal trauma
3. To perform pre-operative and post-operative assessment and coordination of care of patients with advanced eyelid, lacrimal, and orbital disorders.
4. To describe the etiology, evaluation, and management of the following
  - a. Complex ectropion
  - b. Complex entropion
  - c. Complex myogenic ptosis
  - d. Benign, pre-malignant, and malignant eyelid tumors
  - e. Complicated orbital disease
    1. Complex orbital infections (preseptal and orbital cellulitis, mucormycosis, aspergillosis)
    2. Congenital tumors
    3. Fibro-osseous disorders and tumors
    4. Vascular tumors
    5. Xanthomatous tumors
    6. Neural tumors
    7. Rhabdomyosarcoma
    8. Orbital Pseudotumor
    9. Lymphoid lesions
    10. Thyroid related orbitopathy

- 11. Metastatic tumors
  - f. Facial dystonia
  - g. Facial nerve palsy
- B. Technical/Surgical Skills
  - 1. To describe the indications for and perform advanced “in office” examination techniques for less common oculoplastic abnormalities.
  - 2. To describe the indications for and to interpret CT and MRI scans and to identify more advanced orbital pathology on imaging studies.
  - 3. To recognize and treat complex socket related complications (implant extrusions)
  - 4. To perform advanced eyelid procedures
    - a. Biopsy procedures
    - b. Lateral tarsal strip
    - c. Lid suture procedures (Quickert sutures)
    - d. Medial spindle
    - e. Retractor insertion
    - f. Levator advancement
    - g. Eyelid laceration/margin repair
    - h. Tarsorrhaphy
    - i. Blepharoplasty
    - j. Gold weight placement for facial nerve palsy
    - k. Eyelid reconstruction following trauma/tumor excision
  - 5. To describe the management and perform advanced techniques for treatment of lacrimal system abnormalities
    - a. Dacryocystorhinostomy
    - b. Conjunctivodacryocystorhinostomy
    - c. Dilation and probing of nasolacrimal duct
    - d. Dacryoplasty
  - 6. To describe, recognize the indications for and complications of, and perform basic orbital surgery
    - a. Anterior orbitotomy for tumor biopsy/excision
    - b. Anterior orbitotomy for orbital decompression
    - c. Orbital floor fracture repair
  - 7. To describe the indications for and perform botulinum toxin injections
- C. The above objectives will be achieved through**
  - 1. A series of lectures to be given during the Basic Science Course and repeated twice during the 36 months of residency training (See lecture schedule above)
  - 2. Oculoplastics Clinic
  - 3. Journal club sessions
  - 4. Review of the HSRC
  - 5. Case presentations in Grand Rounds
  - 6. Clinical-Pathologic Correlation

**D. Completion of the objectives will be measured by**

1. OKAP
2. OCEX
3. OCAT
4. ORSSA
5. Portfolio



## Low-Vision.

### YEAR 1

#### A. Cognitive Skills

1. To describe low vision assessment techniques (e.g., Early Treatment of Diabetic Retinopathy Study charts, Sloane charts)
2. To describe significant co-morbidities that impact low vision rehabilitation.
3. To describe various low vision aids.
4. To describe the optics of low vision devices.
5. To be sensitive to psychological and emotional aspects of visual impairment.
6. To describe challenges commonly encountered by individuals with visual impairment.
7. To prescribe simple but appropriate rehabilitative therapies and optical devices to help the patient meet his/her goals (e.g. magnification, illumination)
8. To describe functional implications of various visual system pathologies and diseases.
9. To describe visual field enhancing techniques for hemianopic field loss.
10. To describe the difference between visual acuity testing at both distance and near and contrast sensitivity testing.
11. To describe the evaluation of and rationale for licensing automobile drivers who are visually impaired; to understand the local licensing regulations.
12. To describe evaluation of visual acuity and visual field for determination of disability.

### YEAR 2

(In addition to Basic Level goals)

#### A. Cognitive Skills

1. To recognize significant co-morbidities that impact low vision rehabilitation.
2. To recognize and describe clinical applications, indications, and limitations of the various low vision aids ( e.g., CCTV, magnification, large print, Braille, computers with artificial speech)
3. To describe the more advanced optics of low vision devices.

#### B. Technical Skills

1. To prescribe more complex rehabilitative therapies and optical devices.
2. To apply and prescribe visual field enhancing techniques for hemianopic field loss.

3. To perform evaluation of vision assessment in licensing drivers who are visually impaired.
4. To evaluate visual acuity and visual field for determination of disability (for legal and insurance purposes).
5. To demonstrate low vision devices and educate low vision patients on the uses and limitations of these devices.

### YEAR 3

(In addition to Standard Level goals)

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

1. To treat significant co-morbidities that impact low vision rehabilitation
2. To describe indications for the most complex vision aids.
3. To apply more complex principles of optics of low vision devices.

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

1. To prescribe the most complex rehabilitative therapies and optical devices to help the patient meet his/her goals.
2. To apply and prescribe the most complex visual field enhancing techniques for hemianopic field loss.

**The above objectives (YEAR2 to YEAR4) will be achieved through.**

1. 12 hrs of lectures divided in five sessions throughout the academic year.
2. Practice sessions with the support and supervision of an optometrist with low vision and rehabilitation specialty.
3. Ancillary videos and handouts.

**Completion of the objectives (YEAR2 to YEAR4) will be measured by:**

1. OKAP
2. OCEX
3. Portfolio

## Retina

### Basic Level Goals (YEAR 1)

#### A. Cognitive skills:

1. Describe the anatomy of the retina, retinal pigment epithelium, Bruch's membrane, and choroid.
2. Describe the physiology of the retina and retinal pigment epithelium.
3. Understand the principles, technique, side effects, clinical indications, phases, as well as the fluorescence patterns of fluorescein angiography.
4. Understand the principles of optical coherence tomography.
5. Describe etiologies, mechanisms and features of retinal detachment.
6. Recognize and evaluate posterior vitreous detachment and retinal detachment.
7. Describe features of, and recognize common retinal vascular conditions such as diabetic retinopathy, retinal vein and artery occlusions.
8. Describe features of common macular disorders such as age-related macular degeneration, cystoid macular edema, macular hole, macular pucker and some common macular dystrophies.
9. Describe features of common retinal hereditary conditions such as retinitis pigmentosa.
10. Describe features of and recognize commotio retina, choroidal rupture, and Purtscher's retinopathy.
11. Describe the basic principles of laser photocoagulation.

#### B. Technical skills:

1. Perform direct ophthalmoscopy.
2. Perform indirect ophthalmoscopy.
3. Perform slit-lamp biomicroscopy with 90 D, 78 D, 3-mirror Goldmann, posterior pole contact, and wide-field contact lenses.
4. Interpret the fluorescein angiography results of common retinal vascular diseases such as diabetic retinopathy, retinal artery and vein occlusions, and common macular diseases such as age-related macular degeneration and cystoid macular edema.
5. Interpret the optical coherence tomography results of common retinal vascular diseases such as diabetic retinopathy, and vein occlusions, and common macular diseases such as age-related macular degeneration and cystoid macular edema.

### Standard Level Goals (YEAR 2): Including Basic Level Goals

#### A. Cognitive skills:

1. Describe more complex anatomy of the retina, retinal pigment epithelium, bruch's membrane, and choroid.
2. Describe more complex physiology of the retina and retinal pigment epithelium.

3. Describe the principles, technique, side effects, clinical indications, phases, as well as the fluorescence patterns of fluorescein angiography in a more complex way.
4. Describe the principles, technique, side effects, and clinical indications of indocyanine green angiography.
5. Describe more advanced principles of optical coherence tomography.
6. Describe principles of ocular ultrasonography.
7. Describe the principles and indications of electrophysiologic testing such as ERG, EOG, VEP, and multifocal ERG.
8. Describe features and recognize types of retinal detachment; rhegmatogenous, tractional, exudative, as well as clinical evaluation, management and treatment of the condition.
9. Describe, recognize, and evaluate peripheral retinal diseases and vitreous conditions.
10. Recognize, diagnose, evaluate, and treat retinal vascular diseases:
  - a. Diabetic retinopathy
  - b. Non-proliferative diabetic retinopathy
  - c. Proliferative diabetic retinopathy
  - d. Hypertensive retinopathy
  - e. Retinal vein occlusions
  - f. Retinal artery occlusions
  - g. Retinal arterial macroaneurysm
  - h. Ocular ischemic syndrome
  - i. Radiation retinopathy
  - j. Sick cell retinopathy
  - k. Coat's disease
  - l. Idiopathic juxtafoveal retinal telangiectasis
  - m. Peripheral retinal vascular occlusive disorders such as Familial exudative vitreoretinopathy, Eales' disease.
11. Describe the principles and stages of retinopathy of prematurity as well as to recognize the clinical indications of treatment and complications of this disease.
12. Describe, recognize, and evaluate macular diseases such as:
  - a. Age-related macular degeneration
  - b. Non-exudative
  - c. Exudative
  - d. Miscellaneous macular conditions
  - e. Angioid streaks
  - f. Myopic degeneration
  - g. Presumed ocular histoplasmosis syndrome
  - h. Idiopathic central serous chorioretinopathy
  - i. Macular holes
  - j. Epiretinal membranes and vitreoretinal traction syndrome
  - k. Cystoid macular degeneration
  - l. Optic pit with associated macular serous detachment
13. Describe, recognize, and evaluate hereditary retinal and choroidal dystrophies such as:
  - a. Retinitis pigmentosa, rod-cone dystrophies
  - b. Stargardt's disease

- c. Best's disease
  - d. Adult foveomacular dystrophy
  - e. Cone and cone-rod dystrophies
  - f. Choroideremia
  - g. Gyrate atrophy
  - h. Congenital stationary night blindness
  - i. Albinism
  - j. X-linked juvenile retinoschisis
14. Describe, recognize, evaluate, and treat drug and light toxicity of retina and choroids.
15. Describe, recognize, evaluate, and treat choroidal detachments.
16. Describe, recognize, evaluate, and treat infectious and non-infectious inflammatory conditions of posterior segment including endophthalmitis.
17. Describe the relevant findings of the major clinical trials of vitreoretinal diseases:
- a. Early Treatment of Diabetic Retinopathy Study (ETDRS)
  - b. Diabetic Retinopathy Study (DRS)
  - c. Diabetes Control and Complications Trial (DCCT)
  - d. United Kingdom Prospective Diabetes Study (UKPDS)
  - e. Diabetic Retinopathy Vitrectomy Study (DRVS)
  - f. Branch Vein Occlusion Study (BVOS)
  - g. Central Vein Occlusion Study (CVOS)
  - h. Macular Photocoagulation Study (MPS)
  - i. Age-Related Eye Disease Study (AREDS)
  - j. Treatment of Age-Related Macular Degeneration with Photodynamic Therapy Investigation (TAP)
  - k. Verteporfin in Photodynamic Therapy Study (VIP)
  - l. Visudyne in Minimally Classic Choroidal Neovascularization Study (VIM)
  - m. VEGF Inhibition Study in Ocular Neovascularization Clinical Trial
  - n. Minimally Classic/Occult Trial of the Anti-VEGF Antibody Ranibizumab in the Treatment of Neovascular AMD (MARINA) trial
  - o. RhuFab V2 Ocular Treatment Combining the Use of Visudyne to Evaluate Safety (FOCUS) trial
  - p. Anti-VEGF Antibody for the Treatment of Predominantly Classic Choroidal Neovascularization in AMD (ANCHOR) Study
  - q. Cryotherapy for Retinopathy of Prematurity Study (Cryo-ROP)
  - r. Endophthalmitis Vitrectomy Study (EVS)
18. Describe clinical indications and complications of laser photocoagulation.
19. Describe the principles, techniques as well as clinical indications and complications of primary retinal detachment repair
- a. Pneumatic retinopexy
  - b. Scleral buckle retinopexy
  - c. Pars plana vitrectomy
20. Describe basics and principles of vitreous surgery:
- a. Vitrectomy for Proliferative Vitreoretinopathy
  - b. Macular hole surgery
  - c. Epiretinal membrane peeling

- d. Use of gas and silicone oil tamponade as well as use of perfluorocarbon liquids.
- e.

**B. Technical skills:**

1. Perform indirect ophthalmoscopy using scleral indentation.
2. Perform slit-lamp biomicroscopy with 90 D, 78 D, 3-mirror Goldmann, posterior pole contact, and wide-field contact lenses.
3. Perform fundus drawing of the retina demonstrating vitreoretinal findings.
4. Interpret the fluorescein angiography results of known retinal diseases.
5. Interpret the optical coherence tomography images of known retinal diseases.
6. Interpret basic ocular ultrasonography images.
7. Interpret basic electrophysiological tests such as ERG and EOG.
8. Perform panretinal laser photocoagulation under direct supervision.
9. Assist in cryotherapy treatment of retinal breaks or perform the procedure under direct supervision.
10. Assist in scleral buckle retinopexy or perform the procedure under direct supervision.
11. Assist in retinal surgery.

**Advanced Level Goals (YEAR 3): Including Basic and Standard Level Goals**

**A. Cognitive skills:**

1. Apply and correlate complex knowledge of anatomy and physiology of the retina, retinal pigment epithelium, Bruch's membrane, and choroid to clinical practice.
2. Apply and clinically correlate advanced knowledge of fluorescein and angiography of more complex retinal diseases.
3. Apply and clinically correlate complex knowledge of optical coherence tomography.
4. Apply and clinically correlate complex concepts of ocular ultrasonography.
5. Apply and clinically correlate complex concepts of electrophysiologic testing; ERG and EOG.
6. Recognize, evaluate and treat or refer more complex forms of retinal detachment; recurrent retinal detachment, combined tractional/rhegmatogenous retinal detachments and proliferative vitreoretinopathy as well as giant tear associated retinal detachments.
7. Recognize, evaluate, and clinically apply knowledge of more complex peripheral retinal diseases and vitreous conditions.
8. Evaluate, treat or refer more complex forms of retinal vascular diseases:
  - a. Diabetic retinopathy
  - b. Hypertensive retinopathy
  - c. Retinal vein occlusions
  - d. Retinal artery occlusions
  - e. Combined arterial and venous occlusions
  - f. Acquired retinal vascular diseases

- g. Peripheral retinal vascular occlusive diseases
  - h. Diagnose, evaluate and refer cases of retinopathy of prematurity.
  - i. Evaluate, treat or refer more complex or atypical clinical presentations of macular diseases such as:
    - j. Age-related macular degeneration
    - k. Subfoveal choroidal neovascularization
    - l. Recurrent choroidal neovascularization
    - m. Miscellaneous etiologies for macular choroidal neovascularization
    - n. Subfoveal choroidal neovascularization secondary to angioid streaks
    - o. Subfoveal choroidal neovascularization secondary to myopic degeneration
    - p. Subfoveal choroidal neovascularization secondary to presumed ocular histoplasmosis syndrome
    - q. Recurrent or chronic Idiopathic central serous chorioretinopathy
    - r. Refractory cystoid macular degeneration
    - s. Idiopathic Polypoidal Choroidal Vasculopathy
9. Evaluate, treat or refer more complex or atypical clinical presentations of hereditary retinal and choroidal dystrophies such as:
- a. Retinitis pigmentosa, rod-cone dystrophies and retinitis pigmentosa associated to systemic diseases (Usher syndrome, Laurence-Moon Bardet-Biedl, Kearns-Sayre syndrome)
  - b. Stargardt's disease
  - c. Best's disease
  - d. Adult foveomacular dystrophy
  - e. Cone and cone-rod dystrophies
  - f. Choroideremia
  - g. Gyrate atrophy
  - h. Congenital stationary night blindness
  - i. Albinism
  - j. X-linked juvenile retinoschisis
  - k. Dominant drusen (Malattia Leventinese)
  - l. Hyalodeoretinopathies such as Stickler syndrome, Goldmann-Favre, Wagner, Jansen disease.
10. Evaluate, treat or refer more complex forms of infectious and non-infectious inflammatory conditions of posterior segment, including the white dot syndromes, endogenous endophthalmitis and sympathetic ophthalmia.
11. Describe and clinically apply the findings of the major clinical trials of vitreoretinal diseases:
- a. Early Treatment of Diabetic Retinopathy Study (ETDRS)
  - b. Diabetic Retinopathy Study (DRS)
  - c. Diabetes Control and Complications Trial (DCCT)
  - d. United Kingdom Prospective Diabetes Study (UKPDS)
  - e. Diabetic Retinopathy Vitrectomy Study (DRVS)
  - f. Branch Vein Occlusion Study (BVOS)
  - g. Central Vein Occlusion Study (CVOS)

- h. Macular Photocoagulation Study (MPS)
  - i. Age-Related Eye Disease Study (AREDS)
  - j. Treatment of Age-Related Macular Degeneration with Photodynamic Therapy Investigation (TAP)
  - k. Verteporfin in Photodynamic Therapy Study (VIP)
  - l. Visudyne in Minimally Classic Choroidal Neovascularization Study (VIM)
  - m. VEGF Inhibition Study in Ocular Neovascularization Clinical Trial
  - n. Minimally Classic/Occult Trial of the Anti-VEGF Antibody Ranibizumab in the Treatment of Neovascular AMD (MARINA) trial
  - o. RhuFab V2 Ocular Treatment Combining the Use of Visudyne to Evaluate Safety (FOCUS) trial
  - p. Anti-VEGF Antibody for the Treatment of Predominantly Classic Choroidal Neovascularization in AMD (ANCHOR) Study
  - q. Cryotherapy for Retinopathy of Prematurity Study (Cryo-ROP)
  - r. Endophthalmitis Vitrectomy Study (EVS)
12. Recognize, evaluate, and treat complications of laser photocoagulation.
  13. Describe clinical indications and complications of photodynamic therapy with verteporfin
  14. Describe clinical indications and complications of anti-VEGF therapy.
  15. Apply in clinical practice more complex surgical techniques for retinal detachment repair
    - a. Scleral buckle retinopexy
    - b. Pars plana vitrectomy
  16. Apply in clinical practice more complex surgical techniques of vitreous surgery:
    - a. Complex vitrectomy for Proliferative Vitreoretinopathy
    - b. Complex vitrectomy for diabetic retinopathy tractional retinal detachments
    - c. Complex vitrectomy for combined tractional/rhegmatogenous retinal detachments due to diabetic retinopathy
    - d. Macular hole surgery
    - e. Epiretinal membrane peeling
    - f. Use of perfluorocarbon liquid

## **B. Technical skills:**

1. Perform indirect ophthalmoscopy using scleral indentation in complex retinal cases with detailed retinal drawing documentation.
2. Perform slit-lamp biomicroscopy with 90 D, 78 D, 3-mirror Goldmann, posterior pole contact, and wide-field contact lenses of more complex retinal conditions.
3. Interpret and clinically correlate fluorescein angiography results of more complex or advanced conditions.
4. Interpret and clinically correlate optical coherence tomography and ultrasonography images of more complex retinal diseases.
5. Interpret and correlate electrophysiological tests such as ERG and EOG of more complex conditions.



6. Perform laser photocoagulation under supervision:
  - a. Focal/grid laser photocoagulation
  - b. Panretinal laser photocoagulation
  - c. Laser demarcation of peripheral retinal lesions
7. Assist in cryotherapy treatment of more complex retinal pathology or perform the procedure under direct supervision.
8. Assist in scleral buckle retinopexy of more complex retinal detachment or perform the procedure under direct supervision.
9. Assist in advanced pars plana vitrectomy or perform the procedure under direct supervision.

Above objectives will be covered by:

I. The following topics distributed in the appropriate manner within lectures given twice during 36 months of training.

1. Anatomy and Physiology
  - a. Anatomy of vitreous, retina, RPE, bruch's membrane, and choroid
  - b. Physiology of retina and RPE.
2. Diagnosis
  - a. Fundus examination
  - b. Fluorescein angiography, indocyanine angiography
  - c. Optical coherence tomography
  - d. Ultrasonography
  - e. Electrophysiologic tests
3. Diseases of retina, macula, vitreous, choroid.
  - a. Retinal Vascular Diseases
  - b. Diabetic Retinopathy
  - c. Hypertensive retinopathy
  - d. Venous occlusive disease
  - e. Arterial occlusive disease
  - f. Sickle cell retinopathy
  - g. Retinal Arterial Macroaneurysm
  - h. Cystoid Macular Edema
  - i. Coat's disease
  - j. Parafoveal Telangiectasis
  - k. Retinopathy of Prematurity
  - l. Ocular Ischemic Syndrome
  - m. Radiation Retinopathy
  - n. Familial Exudative Vitreoretinopathy
  - o. Eales' Disease
  - p. Vasculitis
  - q. Age-Related Macular Degeneration
  - r. Miscellaneous Macular Degenerations
  - s. Central Serous Chorioretinopathy
  - t. Macular Holes
  - u. Epiretinal Membranes and Vitreomacular traction syndrome
4. Inherited Conditions
  - a. Macular dystrophies

- b. Generalized retinal and choroidal dystrophies
  - c. Hyalodeoretinopathies
  - d. Phakomatoses
  - e. Metabolic Diseases
- 5. Peripheral retinal abnormalities
  - a. PVD
  - b. Retinal breaks
  - c. Lesions predisposing to RD
  - d. Lesions not predisposing to RD
  - e. RD, PVR
- 6. Congenital fundus anomalies
- 7. Drug Toxicity
- 8. Trauma
  - a. Traumatic retinal detachments
  - b. Commotion retina
  - c. Choroidal rupture
  - d. Chorioretinitis sclopetaria
  - e. Optic nerve avulsion
  - f. Intraocular foreign body
  - g. Purtscher's retinopathy, Terson's syndrome, shaken baby syndrome, Valsalva retinopathy
- 9. Posterior segment complications of anterior segment surgery
  - a. Endophthalmitis
  - b. Choroidal detachment
  - c. Suprachoroidal Hemorrhage
  - d. Retained lens fragments
  - e. Needle penetration of the globe
  - f. Intraocular lens dislocation
- 10. Intraocular tumors (retina, choroid, ciliary body, optic disc)
- 11. Inflammatory diseases
  - a. Non-infectious
  - b. Infectious
- 8. Interaction between faculty and resident during General and Glaucoma clinics.
- 9. Journal club sessions.
- 10. Review of the HSRC.
- 11. Case presentations.
- 12. Discussion of complicated cases and Clinical-Pathologic correlation.

Completion of these objectives will be measured by:

- 1. OKAP.
- 2. OCEX.
- 3. OCAT.
- 4. ORSSA
- 5. Portfolio.
- 6. Journal Club evaluations.
- 7. Case presentations.

## Uveitis and Ocular Inflammation

### YEAR 1

#### A. Cognitive skills

1. To describe the principles of history taking and examination of patients with:
  - a. Uveitis
  - b. Inflammatory ocular conditions (Scleritis, PUK, polychondritis, pemphigoid).
2. To list the signs and symptoms of anterior and posterior uveitis.
3. To describe the different types of uveitis
4. To describe the SUN group classification of uveitis for purpose of international uniformity
5. To describe the typical features and differential diagnosis of anterior uveitis:
  - a. Acute vs chronic
  - b. Infectious vs non-infectious
  - c. Post-traumatic
  - d. Post-surgical
  - e. Lens-related
  - f. Associated with panuveitis or spillover from intermediate or posterior uveitis
6. To describe the clinical features and differential diagnosis of the following posterior and pan-uveitis syndromes
  - a. Toxoplasmosis
  - b. Sarcoidosis
  - c. Vogt-Koyanagi-Harada
  - d. Acute retinal necrosis
  - e. Pars planitis
  - f. Syphilis
  - g. Large cell lymphoma
  - h. Post-operative uveitis
  - i. Sympathetic ophthalmia
  - j. Endophthalmitis
  - k. Post-operative
  - l. Traumatic
  - m. Endogenous
  - n. Chronic and AIDS related uveitis
  - o. CMV retinitis
  - p. Multiple sclerosis

#### B. Technical skills

1. To perform an examination of the anterior and posterior segment of the eye
2. External examination and iris color
3. Pupillary examination and reaction to light
4. Slit-lamp biomicroscopy

5. Classify grade of inflammation (flare and cells)
6. Vitreous examination
7. Fundus examination
8. Indirect ophthalmoscopy and scleral depression
9. Fundus contact lens exam
10. Differentiate between primary choroidal or retinal lesions
11. To describe indications for ancillary testing in uveitis
  - a. Ultrasound
  - b. Fluorescein angiography
  - c. OCT
  - d. PAM
  - e. CT scan or MRI
  - f. PCR
12. To be able to order a laboratory and radiologic work-up oriented toward the specific clinical findings of individual patients.

## YEAR 2

### A. Cognitive skills

1. To describe more advanced principles of history taking and examination of uveitis and other ocular inflammatory disorders, including a review of systems for the following conditions
  - a. Wegener's granulomatosis
  - b. Polyarteritis nodosa
  - c. Systemic lupus erythematosus
  - d. Rheumatoid arthritis
  - e. Relapsing polychondritis
  - f. Systemic necrotizing vasculitis
  - g. Inflammatory bowel disease
2. To list less common signs and symptoms of uveitis
3. To list differentiating signs of less common forms of uveitis
4. To describe the differential diagnosis of less common forms of uveitis
  - a. Chronic uveitis
  - b. Intermediate uveitis
  - c. Infectious uveitis
  - d. Inflammatory posterior uveitis (white dot syndromes)
  - e. Masquerade syndromes
5. To evaluate and treat common causes of anterior and posterior uveitis

### B. Technical skills

1. To perform a directed examination of the anterior and posterior segment for uveitis
2. Slit-lamp biomicroscopy
3. Magnified posterior segment exam
4. Scleral depression
5. Vitreous examination for cells
6. To perform ancillary testing for uveitis
  - a. Ultrasound
  - b. PAM

- c. OCT
- d. Anterior chamber and vitreous diagnostic taps
7. To administer periocular and intraocular steroid injections

### YEAR 3

#### A. Cognitive skills

1. To recognize, evaluate and treat uveitis in immunocompromised individuals
  - a. AIDS in its different stages of immunosuppression
  - b. Pharmacologic immunosuppression
  - c. Age related immunosuppression
  - d. Disease related immunosuppression
2. To recognize, evaluate and treat congenital syphilis
3. To recognize, evaluate and treat (or refer) less common, rare or tropical conditions associated with uveitis
4. To describe indications and contraindications for corticosteroid treatment of uveitis
  - a. Topical
  - b. Local
  - c. Systemic
  - d. Intraocular
5. To know the risks and benefits of the use of above steroid therapies
6. To describe the indications and contraindications of immunomodulatory therapy in uveitis
  - a. Antimetabolites
  - b. Alkylating agents
  - c. Biologic agents
  - d. Cyclosporine
7. To be able to know when to refer uveitis cases

#### B. Technical skills

1. Administration of local steroid or other uveitis medications
2. Cataract surgery in uveitis
  - a. Pre-surgical preparation
  - b. Intraoperative techniques
  - c. Post-operative management of inflammation or complications
3. To recognize, evaluate and manage complications of uveitis
  - a. Cataracts
  - b. Glaucoma
  - c. Hypotony
  - d. Retinal detachment
  - e. Cystoid macular edema

Above objectives will be covered by:

1. The following lectures given once during the Basic Course and twice during the rest of the 36 months of training.
  - a. Introduction to uveitis
  - b. Anterior uveitis
  - c. Intermediate uveitis
  - d. Posterior uveitis- Non-infectious causes
  - e. Posterior uveitis-Infectious causes
  - f. Panuveitis
  - g. AIDS
  - h. Scleritis
  - i. Peripheral ulcerative keratitis (PUK)
  - j. Cicatrizing conjunctivitis
2. Interaction between faculty and resident during General and Glaucoma clinics.
3. Journal club sessions.
4. Review of the HSRC.
5. Case presentations.
6. Discussion of complicated cases.
7. Clinical-Pathologic correlation.

Completion of these objectives will be measured by:

1. OKAP.
2. OCEX.
3. OCAT.
4. ORSSA
5. Portfolio.
6. Journal Club evaluations.
7. Case presentations.

## Ocular Oncology

### YEAR 1

#### A. Cognitive skills

1. The resident should know pertinent terminology to describe the condition being evaluated like papillomatous, mobile, pigmented, erosive, ulcerated, vascularized, etc.
2. The resident should be able to establish a differential diagnosis for these lesions
3. The resident should be able to describe the basic categorization of common extra and intra ocular tumors.
4. The resident should be able to describe the differential diagnosis, epidemiology, evaluation, and management of leukocoria
5. The resident should be able to describe the major diagnostic features of intraocular tumors (retinoblastoma, melanoma, metastatic) and its differential diagnosis

#### B. Technical skills

1. The resident must be able to perform a complete history and ocular exam.
2. The resident must recognize an ocular tumor and refer appropriately.
3. The resident must be able to inject local anesthetics on eyelids and perform skin biopsy of lesions outside the lid margin.

### YEAR 2

#### A. Cognitive skills

1. The resident must be able to describe the management options for different intraocular tumors
2. The resident must be able to describe the findings of the Collaborative Ocular Melanoma Study (COMS)
3. To describe the classification of retinoblastoma and its treatment.
4. To describe the basic histopathology of intraocular tumors
5. To list the differential diagnosis for tumors of the iris, ciliary body, choroids, retina and optic disc
6. To describe diagnostic techniques for common intraocular tumors
7. To describe the prognostic significance of different types of ocular tumors and to guide evaluation for systemic involvement.
8. To be familiar with the role of sentinel lymph nodes biopsies and its role in the management of lid and conjunctival neoplasms.
9. To describe indications for excision of conjunctival, corneal and intraocular tumors.
10. To describe indications for techniques and complications of radiation therapy for ocular tumors

**B. Technical Skills**

1. To perform indirect ophthalmoscopy, draw the lesion, determine its localization, dimensions and impact on other ocular structures.
2. To describe indications for examination under anesthesia
3. To perform an enucleation.
4. To obtain biopsies of lesions involving lid margin as well biopsies of conjunctival and corneal lesions.
5. To discuss various treatment options with patients and relatives in a detailed, ethical and comprehensive manner.

**YEAR 3****A. Cognitive skills**

1. To describe the management of unusual intraocular tumors ( choroidal metastasis, choroidal osteoma)
2. To apply the findings of the Collaborative Ocular Melanoma Study
3. To recognize, evaluate and treat most extra and intraocular tumors
4. To be familiar with Mohs surgery and its indications

**B. Technical skills**

1. To perform examination under anesthesia for pediatric intraocular tumors
2. To perform and interpret A and B scan echography for intraocular tumors
3. To interpret fluorescein angiography for intraocular tumors
4. To obtain a Ret Cam picture in a child
5. To perform complicated enucleation or exenteration
6. To be able to interpret neuro-imaging studies (Ct scan , MRI)
7. To describe indications for surgical procedures and their complications and be able to perform or refer for:
  - a. Plaque radiotherapy
  - b. External beam radiation
  - c. Iridectomy or iridocyclectomy
  - d. Resection or cryotherapy of conjunctival tumors or use antimetabolite eyedrops
  - e. Transpupillary thermal therapy

**Above objectives will be covered by:**

1. The following lectures given once during the Basic Course at twice during the rest of the 36 months of training.
  - a. Eyelid Tumors.
  - b. Conjunctival, Corneal and Scleral Tumors, diagnosis and therapy.
  - c. Intraocular Tumors in Children, diagnosis and therapy.



- d. Intraocular Tumors in Adults, diagnosis and therapy.
- e. Orbital Tumors, diagnosis and therapy.
- 2. Journal club sessions.
- 3. Review of the HSRC.
- 4. Case presentations.
- 5. Discussion of complicated cases.
- 6. Clinical-Pathologic correlation.

Completion of these objectives will be measured by:

- 1. OKAP.
- 2. OCEX.
- 3. OCAT.
- 4. Portfolio.
- 5. Journal Club evaluations.

## Pediatric Ophthalmology and Strabismus.

### BASIC LEVEL GOALS: YEAR 1

#### A. Cognitive skills

1. To describe basic examination techniques for strabismus ( e.g., ductions and versions, cover and uncover testing, alternate cover testing, prism cover testing).
2. To describe basic visual development and visual assessment of the pediatric ophthalmology patient ( e.g., central, steady, maintained fixation; illiterate E, Allen cards).
3. To describe basic anatomy and physiology of strabismus ( e.g., innervation of extraocular muscles, primary action, comitant and incomitant deviations, overaction and underaction restrictive and paretic saccades and pursuit movements).
4. To describe basic sensory adaptations for binocular vision ( e.g., normal and anomalous retinal correspondence, suppression, horopter, Panum's area, fusion, stereopsis).
5. To describe and recognize pseudostrabismus.
6. To describe different etiologies of amblyopia ( e.g., deprivation, ametropic, strabismic, anisometropic, organic).
7. To describe etiologies of esotropia ( e.g., congenital, comitant and incomitant, accommodative and non-accommodative, decompensated, sensory, neurogenic, myogenic neuromuscular junction, restrictive, nystagmus blockage syndrome, spasm of the near reflex monofixation syndrome, consecutive).
8. To describe etiologies of exotropia ( e.g., congenital, comitant and incomitant, decompensated, sensory, neurogenic, myogenic neuromuscular junction, restrictive, basic, divergence excess, exophoria, convergence insufficiency).
9. To describe various strabismus patterns ( e.g., A or V pattern).
10. To describe etiologies, evaluation, and management of vertical strabismus ( e.g., neurogenic, myogenic, neuromuscular junction, oblique overaction or underaction, dissociated vertical deviation, restrictive).
11. To describe non-surgical treatment of strabismus.
12. To describe different forms of childhood nystagmus.
13. To describe features, classification, and treatment indications for retinopathy of prematurity.
14. To describe etiologies and types of pediatric cataracts.
15. To describe and recognize ocular findings in child abuse ( e.g., retinal hemorrhages) and appropriately refer to child protective services or other authorities.
16. To describe common hereditary or congenital ocular motility or lid syndromes ( e.g., Duane syndrome, Marcus Gunn jaw winking, Brown syndrome).
17. To describe typical features of retinoblastoma.
18. To describe basic features of dyslexia.

19. To describe basic evaluation of decreased vision in infants and children (e.g., retinopathy of prematurity, hereditary retinal disorders, congenital glaucoma, measles, vitamin A deficiency).
20. To describe identifiable congenital ocular anomalies ( e.g., microphthalmia, persistent fetal vasculature).
21. To describe ocular findings in inherited, metabolic disorders
22. Mucopolysaccharioses ( e.g., Hurler syndrome, Scheie syndrome, Hunter syndrome, San Fillipo syndrome, Morquio syndrome).
23. Lipidoses ( e.g., Tay-Sachs disease, Sandhoff, Niemann-Pick, Krabee's, Gaucher's, Fabry's disease, metachromatic leukodystrophy).
24. Aminoacidurias ( e.g., homocystinuria, cystinosis, Lowe and Zellweger syndromes).
25. To describe ocular findings in chromosomal abnormalities ( e.g., Trisomy 21, Trisomy 13, Trisomy 18, Short arm 11 deletion, Long arm 13 deletion, Cri du Chat, Turner's syndrome)

## STANDARD LEVEL GOALS: YEAR 2

### A. Cognitive skills

1. To describe basic and more advanced strabismus examination techniques ( e.g., combined vertical and horizontal prism cover testing, double Maddox rod testing).
2. To describe basic and more advanced visual development and visual assessment of the pediatric ophthalmology patient ( e.g., blink to light measure of fixation and following behavior, objective measure of visual acuity).
3. To describe more advanced anatomy and physiology of strabismus ( e.g., torsion, tertiary actions, consecutive deviations).
4. To describe more advanced sensory testing ( e.g., anomalous head position).
5. To describe basic of binocular sensory testing ( e.g., Titmus stereo testing, Worth 4-dot, Bagolini lenses, afterimage testing).
6. To describe and to recognize different etiologies of amblyopia.
7. To describe and recognize etiologies of esotropia.
8. To describe and recognize etiologies of exotropia.
9. To describe and recognize various strabismus patterns ( e.g., A or V pattern).
10. To describe and recognize the etiologies of vertical strabismus.
11. To describe and utilize the non-surgical treatment of strabismus and amblyopia ( e.g., patching, atropine penalization, Fresnel and ground-in prisms).
12. To describe and recognize the different forms of childhood nystagmus ( e.g., sensory, motor, congenital, acquired).
13. To describe and recognize retinopathy of prematurity ( e.g., stages, treatment indications).
14. To describe and recognize etiologies and types of pediatric cataracts ( e.g., congenital, traumatic, hereditary, idiopathic).

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

## **B. Technical skills**

1. To perform basic and advanced extraocular muscle examination based on
2. Knowledge of the anatomy and physiology of ocular motility.
3. To apply Hering's and Sherrington's laws.
4. To perform basic measurement of strabismus ( e.g., Hirschberg, Krimsky, cover testing, prism cover testing, simultaneous prism cover testing, alternate cover testing, Parks-Bielschowsky three-step test, Maddox rod testing, double Maddox rod testing).
5. To perform assessment of vision in more difficult strabismus patients (e.g., uncooperative child mentally impaired, nonverbal or preverbal)
6. To 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
  - j. Fixation preference test
  - k. Standard subjective visual acuity tests
  - l. Induced tropia test
7. To assess advanced ocular motility problems ( e.g., bilateral or multiple cranial neuropathy, myasthenia gravis, thyroid eye disease).
8. To perform assessment of vision in more difficult strabismus patients ( e.g., uncooperative child mentally impaired, nonverbal or preverbal).
9. To perform basic extraocular muscle surgery:
10. To exercise surgical judgement for the indications and contraindications for strabismus surgery

11. To perform pre-operative assessment, intraoperative techniques and to describe intraoperative and post-operative complications of strabismus surgery
12. To perform or assist the following strabismus surgeries:
  - a. Recession
  - b. Resection
  - c. Muscle weakening ( e.g., Inferior Oblique myectomy, superior oblique tenotomy) and strengthening ( e.g., tuck procedures
  - d. Transposition
  - e. Use of adjustable sutures
13. To manage the complications of strabismus surgery ( e.g., slipped muscle, anterior segment ischemia).
14. To recognize and treat complex pediatric glaucoma.
15. To recognize and treat complex pediatric cataracts and anterior segment abnormalities (including surgical implications, techniques, and complications)

### ADVANCED LEVEL GOALS: YEAR 3 .

#### A. Cognitive skills

1. To describe and perform the most advanced strabismus examination technique (e.g., complicated prism cover testing in multiple cranial neuropathies, patients with nystagmus, dissociated vertical deviation, double Maddox rod testing).
2. To apply the most advanced knowledge of strabismus anatomy and physiology ( e.g., spiral of tillaux, secondary and tertiary actions, spread of comitance) in evaluation of patients.
3. To describe clinical application of the most advanced sensory adaptations (e.g., anomalous head position, anomalous retinal correspondence).
4. To recognize and treat the most complicated etiologies of amblyopia ( e.g., refraction non-compliance, patching failures, pharmacologic penalization).
5. To recognize and treat the most complex etiologies of esotropia ( e.g., optical, prism-induced, post-surgical/consecutive).
6. To recognize and treat the most complex etiologies of exotropia ( e.g., supranuclear, paralytic pontine exotropia, consecutive).
7. To recognize and treat the most complex strabismus patterns ( e.g., aberrant regeneration, post-surgical, thyroid ophthalmopathy and myasthenia gravis).
8. To recognize and treat the most complex etiologies of vertical strabismus ( e.g., skew deviation, post-surgical, restrictive).
9. To apply non-surgical treatment ( e.g., patching, atropine penalization) of more complicated forms of amblyopia ( e.g., non-compliant patching failures).
10. To recognize, evaluate, and treat the most complex forms of childhood nystagmus ( e.g., sensory, spasmus nutans, associated with neurologic or systemic disease).

11. To recognize and treat ( or refer for treatment) complex retinopathy of prematurity (e.g., stages. Treatment indications, retinal detachment).
12. To recognize and treat ( or refer for treatment) uncommon etiologies and types of pediatric cataracts ( e.g., congenital , traumatic, metabolic, inherited).
13. To recognize and appropriately evaluate the more complex hereditary ocular syndromes ( e.g., bilateral Duane syndrome, Mobius syndrome).
14. To recognize and treat ( or refer for treatment) patients with complicated retinoblastoma ( e.g., bilateral cases, monocular patient, treatment failure, pineal involvement).
15. To recognize and evaluate the less common congenital ocular anomalies ( e.g., unusual genetic syndromes).
16. To 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).
17. To recognize and treat complex pediatric retinal disease ( e.g., inherited retinopathies).
18. To recognize and treat ( or refer) complex pediatric eyelid disorders ( e.g., congenital deformities, lid lacerations, lid tumors).
19. To recognize and treat ( or refer) pediatric eyelid disorders (e.g., orbital tumors, orbital fractures, rhabdomyosarcoma, severe congenital orbital malformations).

## **B. Technical/surgical skills**

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

### **Above objectives will be covered by:**

1. The following lectures given once during the Basic Course at twice during the rest of the 36 months of training.
  - a. Pediatric Eye Examination – Dr. Diana Martínez
    - i. Anatomy and Physiology of Extraocular Muscles
  - b. Amblyopia and Sensory Adaptation – Dr. M De Pool.
  - c. Prescription of glasses in children – Dr. J Rodríguez.

- d. Esotropia – Pediatric Ophthalmology and Strabismus BSC
  - i. Congenital Esotropia
  - ii. Accomodative Esotropia ( Refractive Accommodative Esotropia, Partially Accomodative Esotropia, High AC/A Esotropia)
  - iii. Acquired Non Accomodative Esotropia
  - iv. Cyclie Esotropia
  - v. Divergence Paresis
  - vi. Pseudoesotropia
  - vii. Sensory Esotropia
  
- e. Exotropia – Dr. Linnette Baez
  - i. Intermittent Exotropia
  - ii. Convergence Insufficiency
  - iii. Sensory Exotropia
  - iv. Congenital Exotropia
  
- f. Vertical Strabismus – Dr. Magda De Pool
  - i. Dissociated Vertical Deviation
  - ii. Inferior oblique Overaction
  - iii. Brown’s Syndrome
  - iv. Monocular Elevation Deficiency
  - v. Congenital Fibrosis Syndrome
  - vi. Thyroid Myopathy
  - vii. Blowout Fracture
  
- g. Paralytic Strabismus – Pediatric Ophthalmology and Strabismus BSC
  - i. 3<sup>rd</sup> nerve palsy
  - ii. 4<sup>th</sup> nerve palsy
  - iii. 6<sup>th</sup> nerve palsy
  - iv. Duane’s syndrome
  - v. Myasthenia gravis
  
- h. Nasolacrimal duct obstruction – Pediatric Ophthalmology and Strabismus BSC
  
- i. Pediatric Cataracts – Pediatric Ophthalmology and Strabismus BSC
  
- j. Pediatric Glaucoma – Pediatric Ophthalmology and Strabismus BSC
  
- k. Retinopathy of Prematurity – Pediatric Ophthalmology and Strabismus BSC
  
- l. Phacomatoses – Dr. Luis A. Serrano.

- m. Syndromes with Ophthalmic Manifestation – Dr. M De Pool.
  - i. Aicardi
  - ii. Alport
  - iii. Alstrom
  - iv. CHARGE Association
  - v. Prader Willi
  - vi. Rubinstein-Taybi
  - vii. Lowe
  - viii. Cockayne
  - ix. Cornelia De Lange
  
- n. Metabolic Disorders – Dr. Magda De Pool
  - i. Mucopolysaccharidoses
  - ii. Gangliosidosis
  - iii. Fabry disease
  - iv. Wilson’s disease
  - v. Niemann – Pick
  - vi. Allagille syndrome
  
- o. Connective Tissue, Skin & Bone disorders- Dr. Magda De Pool
  - i. Pseudoxanthoma Elasticum
  - ii. Ehlers-Danlos
  - iii. Marfan
  - iv. Weill-Marchesani
  - v. Stickler
  - vi. Homocystinuria
  - vii. Albinism
  - viii. Incontinentia pigmenti
  - ix. Kniest syndrome
  - x. Osteogenesis imperfecta

2. Interaction between faculty and resident during General and Pediatric clinics.
3. Journal club sessions.
4. Review of the HSRC.
5. Case presentations.
6. Discussion of complicated cases.
7. Clinical-Pathologic correlation.

Completion of these objectives will be measured by:

1. OKAP
2. OCEX
3. OCAT
4. ORSS
5. Portfolio.
6. Journal Club evaluations.
7. Case presentations.



## Cornea, External disease and refractive surgery

### YEAR 1

#### A. Cognitive skills

1. Describe for the cornea, conjunctiva, sclera and lacrimal apparatus
  - a. Anatomy
  - b. Embryology
  - c. Physiology
  - d. Immunology
2. To describe congenital anomalies of the cornea, degenerations, dystrophies , pigmentations, infections and systemic associations and manifestations
3. To describe congenital anomalies, pigmentations, degenerations, infections and systemic manifestations in the conjunctiva and sclera
4. To know basic microbiology and immunology concepts to be applied to corneal and conjunctival disease
5. To recognize and treat basic ocular allergies
6. To recognize and know how to treat : blepharitis, viral and microbial conjunctivitis, viral keratitis, microbial ulcers, neurotrophic ulcers, tear dysfunction, episcleritis and scleritis,
7. To recognize and know how to treat: corneal abrasions, chemical burns, thermal burns superficial foreign bodies lamellar vs. penetrating corneal lacerations, corneal perforations
8. To know and describe use of different diagnostic test: fluorescein, rose Bengal, lisamine green, Schimmer test, impression cytology, Gram stain, KOH and fungal stains
9. To know the optics of the cornea and principles for selective suture removal post cataract surgery or lacerations
10. To know and describe different refractive surgery techniques as : radial keratotomy, astigmatic keratotomy, relaxing incisions, photorefractive keratectomy, laser in situ keratomileusis, intracorneal rings

#### B. Technical skills

1. To perform slit lamp examination and use it in different ways( sclera scatter, direct illumination, retroillumination) to evaluate the different parts of the cornea and pathologies
2. To administer topical anesthesia and different stains to the cornea
3. To perform Schirmmer test
4. To do corneal scrapping and cultures
5. To remove superficial foreign bodies with swabs, needles, spatula or rust ring remover

6. To administer glue with a bandage contact lens for a simple corneal perforation
7. To apply pressure patch for a corneal abrasion
8. To place punctal plugs for tear dysfunction
9. To perform an interpalpebral suture or tarsorrhaphy
10. To perform eye irrigation for chemical burns
11. To perform keratometry
12. To perform suture removal
13. To do pachymetry
14. To do a simple pterygium excision

## YEAR 2

### A. Cognitive skills

1. To recognize and know how to treat more complex corneal and conjunctival infections and diseases as: acanthamoeba keratitis, thygeson keratitis, stromal herpetic disease, ocular pemphigus, interstitial keratitis, Moorens ulcer, Terriens degeneration, marginal keratitis, Stevens Johnson's disease, squamous cell carcinoma
2. To recognize less common dystrophies, degenerations and systemic manifestations
3. To recognize and treat corneal complications of intraocular surgery as corneal edema, Descemet's detachments, wound leakage, thermal burns
4. To recognize and treat corneal graft rejections
5. To recognize and do selective suture removal for postoperative astigmatism in corneal grafts
6. To evaluate and interpret diagnostic test as corneal topography and indications and contraindications for different refractive surgery alternatives
7. To be able to explain optics of refractive surgery techniques.

### B. Technical skills

1. To perform a corneal or scleral laceration repair
2. To perform a recurrent pterygium excision and simple conjunctival flaps and autografts
3. To apply glue to a more complex corneal perforation
4. To do removal of simple squamous cellcarcinomas
5. To assist in corneal graft surgery
6. To be able to assist in a photorefractive keratectomy, laser in situ keratomileusis or intracorneal rings implant
7. To do a corneal topography

**YEAR 3****A. Cognitive skills**

1. To recognize and treat more complex diseases of the cornea and conjunctiva
2. To evaluate more complex cases for refractive surgery
3. To recognize and know how to treat refractive surgery complications

**B. Technical skills**

1. To perform a complex corneal or sclera laceration repair
2. To perform conjunctivoplasty for symblepharon repair with conjunctival graft and amniotic membrane grafts
3. To perform relaxing corneal incisions
4. To perform some steps of a keratoplasty or a full keratoplasty
5. To perform simple iris suturing techniques
6. To perform a tectonic corneal graft for a small perforation
7. To perform a Gundersen's conjunctival flap
8. To do excision of more complex squamous cell carcinomas or conjunctival melanomas
9. To do a deep lamellar keratectomy
10. To do a photorefractive keratectomy or laser in situ keratomileusis

**The above objectives will be covered by:**

1. The following lectures given once during the Basic Course at twice during the rest of the 36 months of training.
  - a. Corneal anomalies
  - b. Corneal degenerations
  - c. Corneal dystrophies
  - d. Red eye differential
  - e. Dry eye
  - f. Keratoconus and other ectatic disorders
  - g. Corneal ulcers
  - h. Herpetic and other viral keratitis
  - i. Keratoplasties
  - j. Corneal trauma
  - k. Pterygium surgery
  - l. Ocular surface reconstruction
  - m. Allergic conjunctivitis
  - n. Cicatricial pemphigoid and the oculodermal diseases
  - o. Corneal topography
  - p. Refractive surgery techniques
2. Journal club
3. HSRC

4. Clinico-pathological correlation

**Completion of objectives will be evaluated by**

1. OKAP
2. OCEX
3. ORSSA
4. Journal club evaluations
5. Case presentations
6. Surgical supervision

## Contact lenses

### YEAR 1

#### A. Cognitive skills

1. To perform a basic contact lens history and exam
2. To know additional test needed for contact lens fitting evaluation: keratometry, fluorescein staining
3. To describe the optics of monofocal soft and hard contact lenses
4. To describe and perform spectacle conversion to contact lens prescription
5. To describe conversion of over retinoscopy or overrefraction for contact lens power determination
6. To describe basic contact lens design, materials and different indications and regimens of use
7. To know selection criteria and contraindications for contact lens
8. To know and recognize contact lens complications as: corneal ulcers, sterile ulcers, corneal edema, corneal neovascularization, giant papillary conjunctivitis
9. To describe safe use and cleaning and disinfection solutions of contact lenses to patients

#### B. Technical skills

1. To perform keratometry
2. To perform retinoscopy over contact lenses
3. To perform a basic soft contact lens fit
4. To perform spherical overrefraction over a monofocal contact lens
5. To evaluate fitting of a contact lens at the slit lamp
6. To manage insertion and removal techniques of soft and hard contact lenses

### YEAR 2

#### A. Cognitive skills

1. To perform a contact lens exam in patient with more complex needs: astigmatism, presbyopia, keratoconus
2. To describe the optics of special design contacts: toric lenses, multifocal, aspheric, keratoconus special designs
3. To evaluate the possibility of monovision in presbyopic patients
4. To describe conversion of over retinoscopy and overrefraction in more complex cases

5. To know how to do adjustment in contact lens fit with changes in base curve and or diameter
6. To know what adjustments to do in cases of complications

### **B. Technical skills**

1. To perform retinoscopy over more complex contact lenses
2. To perform overrefraction including cylinder determination, add determination in cases of presbyopia
3. To perform a monovision fitting including determination of eye dominance
4. To do a basic toric lens contact lens fitting and a basic hard contact lens fitting

## **YEAR 3**

### **A. Cognitive skills**

1. To know more complex lenses designs and material as hybrids, piggyback, narcissus
2. To know principles of orthokeratology
3. To know therapeutic indications of contact lenses as post surgical, bandage lenses, sclera lenses
4. To know how to treat contact lens complications

### **B. Technical skills**

1. To perform more complex lens fittings as in keratoconus, pellucid marginal degeneration, post keratoplasty, children
2. To interpret topography and how to use it as aid for contact lens fitting

### **Above objectives will be covered by:**

1. The following lectures given twice during the rest of the 36 months of training.
  - a. Basic contact lens fitting
  - b. Advanced contact lens fitting
  - c. Contact lens complications
2. Interaction between facultative and resident as fitting of contact lenses is done
3. Case presentations of contact lens complications

**Completion of objectives will be measured by:**

1. OKAP
2. OCEX
3. Case presentations

## Recommended readings and resources.

### General References.

1. Home Study Review Course. American Academy of Ophthalmology. 2014.
2. Albert DM, Jakobiec FA. Principles and practice of ophthalmology. 3<sup>rd</sup> ed. WB Saunders CO. 2008.
3. Kanski JJ. Ophthalmology: A Systematic. 6<sup>th</sup> ed. Approach Betterworth-Heinemann 2011.
4. Wilson FM. Practical ophthalmology: A manual for beginning residents. 6<sup>th</sup> ed. AAO. 2009.
5. Friedman NJ. The Massachusetts Eye and Ear Infirmary Illustrated Manual of Ophthalmology. 3<sup>rd</sup> ed. Elsevier, 2009.
6. Gerstenblith A. The Wills Eye Manual: Office and emergency room diagnosis and treatment of eye disease. 6<sup>th</sup> ed. Lippincott Williams & Wilkins 2012.
7. Yanoff M. Ocular Pathology 6<sup>th</sup> ed. Mosby. 2009
8. Holladay JT. Quality of Vision: Essential Optics for the Cataract and Refractive Surgeon. First Ed. Slack 2007.
9. Rubin ML. The fine art of prescribing glasses without making a spectacle of yourself. 2<sup>nd</sup> ed. Gainesville:Triad Publishing Co. 1991.
10. Shields's Textbook of Glaucoma. 6<sup>th</sup> ed. Lippincott Williams & Wilkins. 2011.
11. Ryan S. Retina. 5<sup>th</sup> ed. Mosby . 2012.
12. Von Noorden GK. Management of Strabismus. 6<sup>th</sup> ed. Mosby 2001.
13. Kline LB. Neuro-Ophthalmology Review Manual. 7<sup>th</sup> ed. Slack 2012.
14. Clinical Pathways in Neuro-Ophthalmology. An Evidence-Based Approach. Lee AG, Brazis PW (Editors). 2003, Thieme New York.
15. Anderson DR, Patella VM. Automated Static Perimetry, 2<sup>nd</sup> ed. St Louis, Mosby, 1999.
16. Leigh RJ, Zee DS. The Neurology of Eye Movements. 4<sup>th</sup> ed. Contemporary Neurology Series. New York, Oxford University Press, 2006.
17. Lim SA, Siatkowski RM. Pediatric neuro-ophthalmology. Curr Opin Ophthalmol 2004; 15: 437-43.
18. Optical coherence tomography of the retina: applications in neurology. Jindahra P, Hedges TR, Mendoza-Santiesteban CE, Plant GT. Curr Opin Neurol. 2010 Feb;23(1):16-23. Review.
19. Neuro-Ophthalmology: Diagnosis and Management by Grant T. Liu MD Dr., Nicholas J. Volpe MD Dr. and Steven L. Galetta MD
20. Electrophysiologic Testing in Disorders of the Retina, Optic Nerve, and Visual Pathway (American Academy of Ophthalmology Monograph Series) by Gerald Allen Fishman, David G. Birch, Graham E. Holder and Mitchell G. Brigell
21. Walsh and Hoyt's Clinical Neuro-ophthalmology: The Essentials. 2<sup>nd</sup> ed. Miller NR, Newman NJ, Kerrison J, Bioussé V (eds). Lippincott Williams and Wilkins, 2008.
22. Hampton Roy F. Master Techniques in Cataract and Refractive Surgery. First ed. Slack 2004
23. Seibel B. Phacodynamics: Surgery. 4<sup>th</sup> ed Slack 2005.



24. Expert Management DVDs, Educational Series AAO.
25. Clinical Skills DVDs, Educational Series AAO
26. Academy Bookshelf DVDs AAO.

### Major Studies and Trials.

1. Herpetic Eye Disease Study (HEDS).
2. Ocular Hypertensive Treatment Study (OHTS).
3. Collaborative Normal Tension Glaucoma Study (CNTGS).
4. Collaborative Initial Glaucoma Treatment Study (CIGTS).
5. Advanced Glaucoma Intervention Study (AGIS).
6. Glaucoma Laser Treatment Trail (GLT) and Follow up (GLTFS).
7. Fluorouracil Filtering Surgery Study (FFSS).
8. Tube vs Trabeculectomy Study (TVT)
9. Optic Neuritis Treatment Trial (ONTT).
10. Ischemic Optic Neuropathy Decompression Trial (IONDT).
11. Diabetic Retinopathy Study Report (DTS).
12. Early Treatment Diabetic Retinopathy Study (ETDRS).
13. Diabetes Control and Complications Research Group (DCCT)
14. Branch Vein Occlusion Study Group (BVOS).
15. Central Vein Occlusion Study Group (CVOS)
16. The Cryotherapy for ROP Cooperative Group (CRYO-ROP)
17. Studies of the Ocular Complications of AIDS (SOCA).
18. Longitudinal Study of Ocular Complications of AIDS (LSOCA).
19. Macular Photocoagulation Study Group (MPS)
20. Age-Related Eye Disease Study Research Group (AREDS).
21. Treatment for Age-Related Macular Degeneration with Photodynamic Therapy (TAP).
22. Submacular Surgery Trials (SST).
23. Intravitreal anti-VEGF agents studies: MARINA, ANCHOR, SAILOR and VISION trials.
24. Collaborative Ocular Melanoma Study (COMS).

### Core Journals.

The following Journals are considered core resources. All of them are available as a service of the American Academy of Ophthalmology to its members through its web site.

1. Ophthalmology.
2. American Journal of Ophthalmology.
3. Survey of Ophthalmology.
4. Ophthalmology Clinics.

### Useful Web Sites.

1. American Academy of Ophthalmology.
  - a. <http://www.aao.org/index.cfm>.
  - b. <http://www.ophsource.org/periodicals>.
  - c. One Network..
2. American Board of Ophthalmology. <http://www.abop.org/>
3. Digital Journal of Ophthalmology. <http://www.djo.harvard.edu/>

4. Online Atlas of Ophthalmology. <http://www.atlasophthalmology.com/>
5. Eye Library.org. <http://www.eyelibrary.org/>
6. Eye Text.Net. <http://www.eyetext.net/>
7. NIH image resources. <http://www.nei.nih.gov/photo/>
8. International Council of Ophthalmology. <http://www.icoph.org/>
9. Royal College of Ophthalmology. <http://www.rcophth.ac.uk/>
10. Royal Australasian College of Surgeons | Ophthalmology. <http://www.surgeons.org/Content/NavigationMenu/WhoWeAre/Specialties/Ophthalmology/default.htm>.
11. Wilmer Ophthalmologic Institute. <http://www.hopkinsmedicine.org/wilmer/>.

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