ICO Subspecialty Curriculum for Training in Cornea, External Diseases, and Refractive Surgery

The International Council of Ophthalmology (ICO) Cornea Subspeciality Curriculum Development Committee has endeavored to present an international consensus on what ophthalmologic subspecialists in training should be taught, with the intention that the curriculum be adapted and modified to meet local and regional needs.

Download the Curriculum from the ICO website: icoph.org/curricula.html.
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The ICO Subspecialty Curricula provide aspects of modern curriculum design that complement the ICO Residency Curriculum, which is a stratified content outline of cognitive and technical skills. The comprehensive definition of a curriculum includes, not only a content outline, but also the resources required to adequately provide training (eg, faculty and facilities), suggested numbers of procedures, teaching methods, and trainee and program evaluations. We believe the incorporation of these crucial components produces a valuable resource. The ICO Subspecialty Curricula are intended to be modified, acknowledging differences across the globe due to available resources, prevalence of disease, and geographic or demographic differences.

As an additional resource, you may also want to refer to the Very Advanced Level Goals content outlines for Cornea and External Diseases and Refractive Surgery in the ICO Residency Curriculum.

[M]: Must have/required
[S]: Should have

Refractive Surgery Program Requirements
Programs wishing to include refractive surgery in their fellowship need to follow the refractive surgery guidelines, which are listed with an asterisk [*]

I. INTRODUCTION

A. Definition and Scope of Subspecialty

Fellowship training requires more in-depth education about the pathophysiology and management of ophthalmic diseases than can usually be obtained in residency (registrar or equivalent) training in ophthalmology. Fellowships include a continuous period of intense and focused training in developing and maintaining knowledge, skills, scholarship, and professionalism.

Subspecialty fellowship training for cornea, external disease, and refractive surgery includes:

1. Diagnosis and medical management of diseases of the eyelid, conjunctiva, cornea/sclera, and anterior ocular segment;
2. Recognition and treatment of posterior segment disease that may affect the anterior segment;
3. Surgery of the conjunctiva, cornea/sclera, anterior segment, lens, and anterior vitreous, with special emphasis on corneal transplantation and related procedures;
4. Principles of contact-lens fitting and management of complications of contact-lens wear; and
5. Principles and practice of keratorefractive surgery.*
B. Duration and Scope of Education

1. Any fellow entering a program should be able to fully comply with the clinical requirements of the program and have completed an appropriate residency program for that subspecialty fellowship. [M]

2. A minimum of 12 months of clinical training is highly recommended, including appropriate short periods for vacation or special assignments. In special circumstances, the training does not have to be continuous as long as the aggregate training is equal to the recommended total. [S]

3. Prior to entry in the program, each fellow should be notified of the length of the program, policies for vacation, duties, stipends, other forms of support, and any restrictions associated with the training. [M]

II. INSTITUTIONAL ORGANIZATION

A. The number of fellowship positions offered will depend on the adequacy of clinical volume, number of faculty, and other resources.

B. Where applicable, the fellowship program should complement, support, and enhance the residency program. Where applicable, the department chair, fellowship program director, and residency program director should work together and periodically meet to assure that the presence of the subspecialty fellowship does not unduly draw cases, learning opportunities, or funding from the residency program.

III. FACULTY QUALIFICATIONS AND RESPONSIBILITIES

A. Fellowship Program Director

There should be a single program director responsible for the fellowship program. [M]

1. Recommended qualifications of the fellowship program director:

   a. Have at least 5 years of clinical subspecialty experience following his/her training, of which at least 50% is dedicated to the subspecialty. [M]

   b. Engage in ongoing academic endeavors in the area of subspecialty training, as demonstrated by regular publications in major peer-reviewed journals, presentation of research material at national meetings, appointments to national or international committees in the recognized specialty; and should be a recognized expert in the field. [M]

   c. Have a clinical practice, of which at least 50% is dedicated to the subspecialty. [S]
d. Be licensed to practice medicine in the country where the program is located. [M]

2. Responsibilities of the fellowship program director:

   a. Develop the educational goals of the program with respect to knowledge, skills, and other attributes for each major rotation or other program assignment. [M]

   b. Develop and maintain documentation of the fellows’ selection process, patient care statistics, evaluations of faculty and the program, and assessment of the fellows’ performance. [S]

   c. Designate and supervise the faculty through explicit descriptions of supervisory lines of responsibility for the care of patients, as well as the skill requirements for the fellows. [M]

   d. Ensure the implementation of fair procedures and due process regarding academic discipline and fellows’ complaints or grievances. [S]

   e. Monitor fellow stress, including mental or emotional conditions inhibiting performance or learning, and drug or alcohol-related dysfunction. [S]

   f. Insure there is health coverage and malpractice insurance for the fellow. [S]

B. Faculty

While the fellowship director will be the principal preceptor, 1 or more additional clinical faculty is highly recommended. Ideally, 1 additional faculty member should have completed 1 year of cornea and external disease fellowship training or equivalent, and have at least 2 years of practice experience in that specialty.

Additional (non-clinical) faculty may include non-ophthalmologists and non-physician doctorates. The expertise of the fellowship director and/or the additional instructors must include keratorefractive surgery for fellowships desiring to list “Refractive Surgery” in addition to “Cornea and External Disease” in their postings and certificates. [S]*

Faculty members should:

1. Possess appropriate clinical and teaching skills, either by subspecialty training or subspecialty oriented clinical practice. [M]

2. Demonstrate a strong interest in the education of fellows; possess sound clinical, research, and/or teaching abilities; support the goals and objectives
of the program; participate in scholarly activities; and be committed to their own continuing medical education. [M]

3. Have regularly scheduled (minimally every 4 months) documented meetings in order to review the program’s goals and objectives, as well as the program’s effectiveness in achieving its goals and objectives. [S]

C. Other Program Personnel

Programs should be provided with the additional professional, technical, and clerical personnel needed to support the administrative and educational activities of the program.

IV. FACILITIES AND RESOURCES

A. Outpatient Examination Facilities

The outpatient area of each participating program should have a minimum of 1 fully equipped examination lane for each fellow. There should be access to current diagnostic equipment. [M]

B. Inpatient Facilities

Inpatient facilities should be available with sufficient space and beds for good patient care. [M]

C. Library or Academic Resources

Fellows should have ready access to a major medical library and/or facilities for electronic retrieval of information from medical databases. [M]

V. EDUCATIONAL PROGRAM

The fellowship director is responsible for the structure and content of the educational program and should provide objectives, methods of implementation, and procedures for assessment of the program. The educational experience should be designed and supervised by the fellowship director.

Fellowship preceptors must emphasize the principles of ethical and humane treatment of patients in accordance with the International Council of Ophthalmology Code of Ethics (www.icoph.org/downloads/icoethicalcode.pdf) and the code of ethics of the supervising bodies of the country in which training takes place. Preceptors and faculty should communicate these principles in both didactic and clinical aspects of the fellowship training. [M]

The program requirements for cornea/external disease fellowships are an in-depth continuation of the general ophthalmology residency program but extend beyond the
normal requirements of a general program. A wider variety of diseases and more patients in each disease category may be encountered. Fellowships may be offered in Cornea and External Disease alone or Cornea, External Disease, and Refractive Surgery. Programs wishing to include refractive surgery in their fellowship need to follow the refractive surgery guidelines, which are listed with an asterisk [*].

A. Clinical Components

The goal of the fellowship is to produce an ophthalmologist with subspecialty skills that allow independent medical and surgical management of cornea and external disease. The subspecialist should at a minimum be able to evaluate a patient with acute or chronic redness of the eye; diagnose acute or chronic loss of vision due to structural changes or anomalies of the anterior segment; be able to create a differential diagnosis for typical corneal findings, for specific anterior segment effects of various systemic and ocular medications, and for surgery of the cornea and conjunctiva; and to delineate the risks and benefits for surgical procedures of the anterior segment.

The subspecialist should be able to probe the patient’s history for relevant review of systems and the social history, including the details of the onset and course of the ocular condition. The subspecialist should be able to complete a detailed examination of the eyelid, orbit, conjunctiva, cornea, anterior chamber, iris, anterior chamber angle, lens, optic disc/nerve, vitreous, retina, and choroid, and perform an evaluation under anesthesia when needed.

The subspecialist should recognize the various tests that are available to aid in the diagnosis of external disease, including evaluation of the tear film, use of the microbiology laboratory, pathology, information available from genetic analysis, special ophthalmic examination techniques (eg, ultrasound, specular microscopy, corneal topography/tomography, and anterior-segment optical coherence tomography [OCT]).

The subspecialist should be able to use all of these skills in order to diagnose and plan the management of disorders relevant to the subspecialty. The fellow should see and be responsible for approximately 2000 cornea and external disease patients to allow necessary experience. [M]

The fellowship program should focus on the following specific areas:

1. Fundamentals of anterior segment anatomy, chemistry, physiology, microbiology and wound healing with focus on the ocular surface, including eyelid function, tear formation and function, corneal topography/tomography, endothelial cell function, and maintenance of corneal clarity. [M]

2. Basic principles of genetics and immunology, including autoimmunity and pathologic responses of the anterior segment. [S]
3. Principles of anterior segment pharmacology (eg, antimicrobial, anti-inflammatory, ocular hypotensive, anesthetics, viscoprotective, immunosuppressive agents, chemotherapeutic, and growth factors), with emphasis on bioavailability, mechanism of actions, relative efficacy, safety, and potential complications. The fellow should be able to formulate fortified antibiotics and antifungal medications. [M]

4. Mastering examination techniques, including biomicroscopy, vital stains of the ocular surface, and special diagnostic testing (eg, specular microscopy, corneal topography/tomography, high-resolution ultrasonography, anterior-segment OCT, confocal microscopy, and corneal pachymetry). In addition, fellows should be familiar with impression cytology, corneal-scraping interpretation of microbiology results, and corneal-biopsy techniques and interpretation. [M]

5. Developmental anomalies of anterior segment, impact on visual developments, and management (eg, eyelid, conjunctiva, cornea, lens, anterior chamber, and iris). [M]

6. Acute and chronic blepharitis to include both infectious and noninfectious etiologies, with emphasis on microbial blepharitis, meibomian gland dysfunction, and rosacea. [M]

7. Disorders of tear production and the lacrimal system, including dry eye disorders both primary and secondary. [M]

8. Acute and chronic infective conjunctivitis (including bacterial, viral, fungal, and parasitic), neonatal conjunctivitis, and chlamydial disease [M]

9. Allergic and toxic conjunctivitis, including vernal, atopic, and seasonal conjunctivitis, giant papillary conjunctivitis, Stevens-Johnson syndrome, toxic conjunctivitis, and conjunctivitis associated with various cutaneous and systemic diseases. [M]

10. Acute and chronic infectious keratitis, including bacterial, viral, fungal, and parasitic, with emphasis on herpes simplex, herpes zoster, adenovirus, acanthamoeba, and contact lens-associated problems. [M]

11. Tumors of the ocular surface, such as sebaceous carcinoma, pigmented lesions, dermoid and choristomas, lymphomas, conjunctival intraepithelial neoplasia, squamous cell carcinoma, vascular and lymphatic tumors. [M]

12. Noninfectious inflammatory diseases of the cornea, including marginal keratitis, interstitial keratitis, keratitis associated with various collagen vascular diseases, Mooren ulcer, epitheliopathies (ie, superficial punctate, filamentary, recurrent erosions, neurotropic), and endotheliopathies. [M]
13. Anterior segment anomalies, including various anomalies associated with specific genetic abnormalities, corneal dystrophies, and corneal degenerations. [M]

14. Autoimmune and immunologic diseases of the anterior segment, including allergy, corneal graft rejection, and cicatrizating conjunctivitis; and familiarity with oral and topical immunosuppression and anti-allergy medications. [M]

15. Pathophysiology and management of allograft rejection, including limbal stem cell rejection, corneal graft rejection, and graft-versus-host disease. [M]

16. Diseases of the sclera, including episcleritis, various forms of immune-mediated scleritis, and infective scleritis. [M]

17. Assessment and emergency management of anterior segment trauma, including chemical, thermal, and mechanical injuries. [M]

18. Fundamentals of preventative, nutritional, and community acquired eye care (e.g., vitamin A prophylaxis, trachoma prevention, onchocerciasis). [M]

19. Fundamentals of refractive surgery and its complications, with special emphasis on forms of keratorefractive surgery, including laser vision correction procedures (e.g., laser-assisted stromal in situ keratomileusis [LASIK] and surface ablation), with an understanding of the different ablation profiles and an understanding of the preoperative evaluations, including topography/tomography and aberrometry.* Additionally there should be either experience or lectures on incisional surgery, thermal keratoplasty, alloplastic inserts, and phakic IOL’s. [S for non-refractive fellowship programs; M for programs including refractive surgery]

20. Skill in anterior-segment surgery, including eyelid, conjunctival, scleral, and corneal procedures, with emphasis on corneal protective procedures (e.g., tarsorrhaphy), conjunctival or amniotic membrane grafts, reconstruction of the ocular surface, surgical management of corneal erosions, and phototherapeutic keratectomy. [M]

21. Skill in penetrating and lamellar keratoplasty, including full thickness transplant and selective transplantation, including endothelial keratoplasty and anterior lamellar keratoplasty, with emphasis on patient selection, surgical technique, and postoperative care. This should include recognition and management of graft rejection and endophthalmitis. The fellow should have knowledge of different techniques of keratoprosthesis surgery. [M]

22. Fundamental knowledge of contact lens physiology, design, and materials; and complications for both cosmetic and therapeutic use. [S]

23. Medical and surgical management of corneal thinning and perforation, including techniques of pharmacological manipulation; and office
procedures such as application of tissue glue and therapeutic contact lenses. [M]

24. Medical and surgical management of complications of intraocular lenses (IOLs), including but not exclusive to, dislocated IOLs, suturing IOLs, iris suturing, and visual aberrations; and complications related to single vision and multifocal IOLs. [M]

25. Inclusion of an eye-banking curriculum, including a review of specific eye-banking functions (eg, recovery, processing, storage, evaluation, distribution of tissue, and donor eligibility). [S]

26. Skill in use of reference material, including electronic searching and retrieval of relevant articles, monographs, and abstracts. [M]

B. Didactic Components

The fellow should exhibit scholarly activity by participating in research and clinical conferences, or their equivalent, for at least the minimum number of hours needed per year to demonstrate competence in the subject. Scholarly activity should consist of:

1. Didactic instruction, seminars, lectures, basic science courses, and hands-on skill courses. [S]

2. Active engagement in at least 1 research project during the fellowship year or be lead author of 1 peer-reviewed publication or presentation at a nationally recognized meeting in corneal and external disease within 1 year of fellowship completion. [S]

When applicable, corneal fellows will participate in the teaching programs of the cornea service and of the institution, if the fellowship is affiliated with a teaching institution or that may be obtained in an exchange program.

1. Attendance at weekly grand rounds or similar venue. The fellow is to actively participate in case presentations and discussions of patients with corneal and external disease. [S]

2. Attendance at monthly morbidity, pathology, and complications conferences. [S]

3. Attendance at lectures on corneal topics given by the faculty during the resident teaching program. These should include at least 6 lecture hours per year. The fellow must prepare and present at least 1 of these lectures. [S]

4. Attendance and participation in courses on anterior segment surgery, corneal transplantation, external disease, and refractive surgery. [S]
5. The fellow should actively participate, along with the cornea faculty, in a journal club at least quarterly. The fellow and faculty should present and critically discuss selections from the current literature. [S]

6. The fellow should attend local and regional conferences relevant to corneal and external disease surgery. [S]

C. Supervision

1. Faculty should be available to supervise fellows as they examine and treat outpatients and inpatients. They should be available for consultation, assistance, and review of the patients. The supervision should be direct for the majority of encounters. Direct faculty supervision occurs when the faculty reviews the findings with the fellow prior to the patient leaving the clinic or being discharged from the hospital. [M]

2. The faculty should participate as primary surgeon or assistant surgeon to the fellow in a sufficient number of surgical procedures to confirm the fellow’s surgical judgment and skill.

3. It is recommended that fellows perform a sufficient number of procedures to achieve competence. Individual programs utilizing these guidelines should determine what the minimum numbers should be, based on local need and resources available.

   a. To gain further competency, the fellow should be the assistant surgeon for at least the minimum number of surgeries needed to demonstrate competence. Procedures should include:

      i. Endothelial replacement corneal transplants; and

      ii. Anterior lamellar transplants.

   b. The fellow should be the primary surgeon for at least the minimum number of surgeries needed to demonstrate competence. Procedures should include:

      i. Endothelial replacement corneal transplants (eg, penetrating or endothelial keratoplasty); and

      ii. Anterior lamellar transplants (eg, deep anterior lamellar keratoplasty).

   In addition, the fellow should:

   c. Receive instruction and develop surgical proficiency in both full thickness penetrating keratoplasty and selective endothelial keratoplasty;

   d. Actively participate in the postoperative management in the majority of grafts where he/she is part of the surgical team;
e. Have sufficient experience with other surgical procedures, including pterygium excision with graft, corneal and conjunctival biopsies, astigmatic keratotomies, and phototherapeutic keratectomy;

f. Participate in the surgery of more complex conditions, including extensive conjunctival reconstruction, amniotic membrane transplantation, lamellar keratoplasties, and limbal stem cell transplantation; and

g. Maintain a surgical log of the type of case and clearly differentiate between being primary surgeon or assisting surgeon. [M]

3. The faculty should make a determination that the fellow uses sound clinical judgment in making recommendations for surgery that is in patients’ best interests. The faculty is responsible in determining that the fellow has sufficient surgical skill to practice independently. [M]

4. In programs offering training in refractive surgery, the fellow should assist and/or observe in at least 50 cases (i.e., LASIK, photo refractive keratectomy [PRK], laser-assisted subepithelial keratectomy [LASEK]) and receive wet lab and certification in those procedures. When possible, hands-on surgical experience is preferable. The fellow should be certified (i.e., approved to use at least 1 refractive laser in their home locale) for PRK and LASIK for programs listing refractive surgery.* [S for nonrefractive fellowship programs; M for programs including refractive surgery]

D. Duty Hours and Conditions of Work

Duty hours and night and weekend call for fellows should reflect the concept of responsibility for patients and provide for adequate patient care. Salary is left up to the discretion of the program. It is strongly suggested that individual health benefits be included in any compensation package (even in the absence of salary). A minimum of 1-week vacation and 1-week of approved conference time should be allotted. A signed agreement between the fellowship director (or institution, practice, or department) and the fellow should be in place outlining the salary and benefits prior to any formal patient contact. The fellow must be made aware of any restrictive covenant prior to accepting the fellowship. [S]

E. Scholarly Activity

The fellowship should take place in a scholarly atmosphere where resources are available that allow the fellow to participate in scholarly activities. Fellows should participate in the development of new knowledge and evaluate research findings. The responsibility for establishing and maintaining an environment of inquiry and scholarship rests with the faculty. While not all members of the faculty must be involved in research, the staff as a whole should demonstrate broad involvement in scholarly activity. This activity should include:
1. Active participation of the faculty in clinical discussions, rounds, and conferences in a manner that promotes a spirit of inquiry and scholarship. Scholarship implies an in-depth understanding of basic mechanisms of normal and abnormal states and the application of current knowledge to practice. [M]

2. Active participation in regional or national professional and scientific societies, particularly through presentations at their meetings and publications in peer-reviewed journals. [S]

3. Participation in research leading to peer-review publications or presentations at regional and national scientific meetings. [S]

4. Adherence by faculty and fellows who participate in research to the Declaration of Helsinki on Rights of Research Human Subjects and to the Association for Research in Vision and Ophthalmology's Guidelines for Use of Research Animals. [M]

F. Fellow Research Activities

The fellow should be exposed to opportunities to develop research skills. A specific block of time may be set aside for clinical or laboratory research. When the research component exceeds 20% of the total time it may be necessary that the fellowship be extended. [S]

VI. EVALUATION

A. Program and Faculty Evaluation

The educational effectiveness of a program should be evaluated in a systematic manner. In particular, the quality of the curriculum, and the extent to which the educational goals have been met by fellows, should be assessed. Teaching faculty should be evaluated on a regular basis. Faculty evaluation should include teaching ability and commitment, clinical knowledge, and academic activity, including publications and participation in national and/or international meetings. There should be a formal mechanism by which fellows participate in this evaluation. Written evaluations by fellows through mechanisms that promote candor and maintain confidentiality, as much as possible, should be utilized in the evaluation of both the program and faculty. [S]

B. Fellow Evaluation

There should be regular evaluation of the fellow's knowledge, skills, and overall performance, including the development of professional attitudes consistent with being a physician.

The program director, with the participation of members of the faculty, shall:
1. At least quarterly review the surgical log and evaluate the knowledge, skills, and professional growth of the fellow. [S]

2. Communicate each evaluation to the fellow in a timely manner. [S]

3. Advance each fellow to positions of higher responsibility on the basis of evidence of their progressive development of knowledge, skills, and professionalism. [S]

4. Maintain a permanent record of evaluation for each fellow. [S]

C. The program director should maintain a written, final evaluation for each fellow who completes the program. The evaluation should include a review of the fellow’s performance during the period of training and should verify that the fellow has demonstrated sufficient professional ability to practice competently and independently. This final evaluation should be part of the fellow’s permanent record maintained by the fellowship director. [S]

ICO Subspecialty Curricula Development Project

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