Curriculum for the FEBOS-CR Exam/ Diploma (Cataract and Refractive Surgery) Exam Date: September 2023

This curriculum addresses:

1. General requirements for applicants
2. Requirements for the institution at which they work
3. Knowledge applicants should have before applying for the exam
4. Experience and self-study requirements
5. Minimum numbers of procedures completed without supervision and confirmation of these

1. General requirements for the candidate

For an applicant to be invited to sit the FEBOS-CR examination, they **must have**:

1. at least **5 years' experience operating without supervision**, having completed a minimum of 4 year's general ophthalmology training. This training should be documented by a recognised fellowship programme diploma (FRCOphth, EBOD, etc.)
2. **completed 1,000 cataract surgeries**, without supervision. These should form a varied case mix, including complex cases. Number of surgeries completed in the past year will also be considered when deciding whether to invite an applicant to sit the examination.
3. practiced without supervision in an institution that offers adequate capacity and the appropriate infrastructure for high quality, diverse exposure to cataract and refractive surgical cases and their management. The institution should have a sufficient number patients as well as an area fully equipped with access to current diagnostic, therapeutic and surgical equipment (see Section 2 Requirements for the institution).

Application to sit the Cataract and Refractive Surgery subspecialty examination is via the EBO. The process is as follows:

1. Please **review the curriculum** to ensure you meet the eligibility criteria
2. **Sign up** (link to the sign up form on the EBO and ESCRS websites) to register your intention to sit the examination
3. **Provide the following materials** before the closing date specified on the website:
   - **EBO-ESCRS CV/ application** (using the template on the ESCRS Examination web page) outlining surgical experience, teaching experience, and publications.
   - **1 video of a complex surgery** you have performed without supervision. Please note the requirements of the video below (Section 4.2 Clinical Exposure)
   - **EBO-ESCRS Examination letter of recommendation** (using the template on the ESCRS Examination web page) from the head of department/ training director or clinical/medical director in the institution. If you hold this role, the practice manager can sign and stamp the letter. This includes a declaration of the number of surgeries you have completed independently, in your career and in the past year.
4. On invitation to sit the examination, you must pay the examination fee by the deadline (July 1st

Deadlines for application and submission of supporting materials will be published on the EBO and ESCRS websites.

At all points in the application and examination process, applicants are responsible for ensuring data protection and appropriate patient confidentiality / consent issues are met relating to materials they submit.

2. Requirements for the institution / peer-recommendation

The EBO-ESCRS does not limit the experience obtained to particular centres but leaves the choice to each applicant. However, particular requirements must be satisfied within the range of the applicant's experiences to achieve the level of "expertise".

2.1 Institution

The applicant's experience must include at least five years' practice without supervision in an institution that offers adequate capacity and the appropriate infrastructure for high quality, diverse exposure to cataract and refractive surgical cases and their management. The institution should have a sufficient number of cataract and refractive surgery patients as well as an area fully equipped with access to current diagnostic, therapeutic and surgical equipment.

The institution must have all the facilities required to allow applicants to perform a diverse range of standard and more complex cataract and refractive surgeries.

The institution must provide access to a medical library or facilities for electronic retrieval of medical literature and information from medical databases.

The institution should also be able to suggest and/or provide access to educational activities, specifically critical evaluation of literature, didactic lectures and grand rounds. Clinical research activities with presentations at meetings should be encouraged.

2.2 Peer-recommendation

Applicants must provide a signed and stamped letter of recommendation from their institution, using the template from the ESCRS Examination web page. Given their level of expertise, the letter is considered a "peer-recommendation" (rather than *trainer* recommendation). This peer recommendation should be from one of the following:

- Medical/ clinical director of the institution
- **Or** the training director of the institution
- **Or** the head of the candidate's department

This person should also certify the number of surgeries completed by the candidate.

If the applicant holds one of these roles, and there is no one in one of the other suitable roles, the practice manager can sign and stamp the letter.

The ESCRS reserve the right to audit an applicant's declared surgical experience, by requesting further details. This may be a registry report (e.g. EUREQUO, EMS report, etc), accounts statement (IOLs implanted by the applicant) or an appropriately anonymised log book for the applicant.

At all points in the application and examination process, applicants are responsible for ensuring data protection and appropriate patient confidentiality / consent issues are met relating to materials they submit.

3 Content of knowledge required prior to application for the exam

Please note in the following sections, a range of issues are covered. However, the items listed are indicative and not definitive – they are intended as guidance. The examination may ask questions about issues not listed below.

3.1 Theoretical knowledge

In addition to the prerequisites from residency training in Ophthalmology listed in the appendix, the applicant must have an extensive and detailed knowledge in the field of cataract and refractive surgery in:

- Epidemiology
- Pathophysiology
- Diagnostics
- Treatment (medical, surgical, laser procedures)
- Informed consent issues
- Complications
- Follow-up

Critical evaluation of literature (Evidence-Based Medicine), including health economics.

3.1.1 Classification of the cataract and list of pathologies

Independently evaluate and establish a management plan for the following pathologies (this list provides guidance and is not complete. You may be asked about issues not listed here):

Types of cataract:

- According to the location of the opacity (nuclear, posterior, etc.)
- According to the aetiology of the cataract (medication, trauma, etc.)
- According to the evolution of the cataract (intumescent, Morganian, hypermature, etc.)
- Congenital/ paediatric cataracts

Combined pathologies:

(This list provides guidance and is not complete. You may be asked about issues not listed here)

- Cataract with glaucoma
- Cataract with corneal pathology
- Cataract with ocular tumours
- Cataract with systemic diseases
- Cataract and diabetes mellitus
- Cataract and retinal disease
- Cataract and uveitis
- Traumatic cataract
- Iridodialysis
- Zonular pathology (lens dislocation and subluxation)

3.2 Complementary Tests to Assess Patient Circumstances and Decision how to Proceed

Order/perform and assess results from the following examinations to determine an appropriate care/ management plan for patients (This list provides guidance and is not complete. You may be asked about issues not listed here):

- Knowledge of all relevant factors in the patient's history (family, personal, medical (systemic and ocular) and surgical).
- Patient symptoms

- Slit lamp examination
- Evaluation of the ocular surface
- Methods of IOP measurement
- Use and interpretation of physiological parameters of the eye using optical/ultrasound imaging techniques, corneal topography, wavefront analysis, OCT, confocal microscopy, Scheimpflug techniques, immersion ultrasonography
- Psychophysical evaluation of quality of vision evaluation (e.g. contrast sensitivity, glare, straylight, etc.)

3.2.1 Basic tests for diagnosis and decision making

Order /perform and assess results from the following examinations to determine an appropriate care/ management plan for patients (This list provides guidance and is not complete. You may be asked about issues not listed here):

- Visual acuity measurement (with and without correction, for distance and near)
- Manifest and cycloplegic refraction
- Pinhole test
- Visual axis and angle Kappa
- Intraocular Pressure measurement
- Fundus evaluation
- Ocular dominance testing

3.2.2 Complementary tests for diagnosis and decision making in cataract surgery

Order/perform and assess results from the following tests to determine an appropriate care/ management plan for patients (This list provides guidance and is not complete. You may be asked about issues not listed here):

- Functional symptoms and quality of life
- Corneal topography/ tomography
- Biometry
- Keratometry (K readings, topography, interferometry, refractometry, etc)
- Wavefront analysis (theory and practice)
- Retina, macula and optic nerve evaluation
- IOL power calculation (see below, Section 3.5.3)

3.3 Surgical and Clinical Skills

The applicant should be able to exhibit critical learning and development skills required for self-directed learning and critical analysis of past and current techniques, as well as interest in current research and future directions in surgical and medical treatment for cataract and refractive pathologies and their complications.

3.3.1 Extensive and detailed knowledge of cataract surgery techniques and management of complications

Techniques

(This list provides guidance and is not complete. You may be asked about issues not listed here)

- Anaesthesia (General, retrobulbar, peribulbar, sub-Tenon, Topical/intracameral)

- Infection prophylaxis
- The use of intraoperative pharmacological agents in cataract surgery
- Equipment for surgery with focus on instrumentation
- Ophthalmic viscosurgical devices
- Techniques for lens removal (e.g. manual techniques, extracapsular cataract extraction, intracapsular cataract extraction, Phacoemulification, MICS, FLACS, reduced nucleus, etc.)
- Cataract surgery for paediatric cataracts

Cataract surgery in specific pathology

(This list provides guidance and is not complete. You may be asked about issues not listed here)

- Anterior segment diseases (cornea, ocular surface, glaucoma, iris problems, etc.)
- Posterior segment diseases
- Uveitis
- Long and short eyes (outliers)
- Trauma
- Combined surgeries

Complications (intra-operative and postoperative)

(This list provides guidance and is not complete. You may be asked about issues not listed here)

For each complication, the applicant must have an understanding of the circumstances, risk factors, management and prevention:

Intra-operative Complications

- Incision complications
- Cornea complications (oedema, burn, etc.)
- Iris complications (Floppy iris, Iris prolapse etc.)
- Capsule complications (rhexis escape, capsule rupture, etc.)
- Zonule complications (loose zonules, rupture, etc.)
- Vitreous (hydration, incarceration, etc.)
- Choroid complications (oedema, detachment, etc.)
- IOL complications (dislocation, decentration, etc.)

Postoperative Complications

- Incision
- Cornea (ocular surface disease, corneal decompensation)
- Iris (iris capture, iridodialysis, etc.)
- Capsule (capsular block, opacification (PCO)
- Retina (CME, retinal detachment)
- Glaucoma
- IOL (malposition, opacification, etc.)
- Infections (endophthalmitis)
- Uveitis (TASS, UGH, etc)

3.3.2 Extensive and detailed knowledge of refractive surgery techniques and management of complications

Techniques

Screen patients for refractive surgery. Develop and carry out patient care management plans, by prescribing and performing procedures essential for the scope of practice, which may include the following (this list provides guidance and is not complete. You may be asked about issues not listed here):

Corneal refractive surgery

- Radial and astigmatic keratotomy
- Excimer laser surface ablation (PRK, LASEK, Epi-Lasik)
- Excimer laser in situ keratomileusis (LASIK)
- Intrastromal lenticule extraction
- PresbyLASIK
- Additive corneal surgery: Rings segments, inlays.
- Corneal cross linking and Conductive keratoplasty

Intraocular refractive procedures

- Phakic IOLs
- Advanced IOLs (aspheric, toric, multifocal, accommodative)
- Add-on IOLs

Complications

(This list provides guidance and is not complete. You may be asked about issues not listed here)

Corneal refractive surgery: intra- and postoperative complications

- Incisional surgery complications (perforation, irregular astigmatism, etc)
- Surface ablation complications (delayed epithelialization, haze, etc.)
- LASIK complications (flap complications, diffuse lamellar keratitis, etc.)
- Decentration
- Iatrogenic ectasia
- Quality of vision impairment
- Intracorneal segments/inlays complications (extrusion, decentration etc.)

Intraocular refractive surgery: intra- and postoperative complications

- Phakic IOLs (endothelial damage, glaucoma, cataract, etc.)
- Advanced IOLs (quality of vision impairment, inadequate refractive outcome, etc.)

Other complications

- Patient dissatisfaction postoperatively
- Ocular surface disease
- Need for refractive enhancement
- Need for piggyback implantation
- IOL calculation in cataract surgery after refractive procedures

3.4 Instrumentation

3.4.1 Exhaustive knowledge of instrumentation for phacoemulsification, including those used for advanced and complicated cases

(This list provides guidance and is not complete. You may be asked about issues not listed here)

- Ultrasound delivery (phaco tips)
- Phaco pump types
- Fluidics
- Surgical instruments and devices (rings, stains, sutures etc.)
- Femtosecond lasers in cataract surgery
- The microscope
- Positioning of the patient's head

3.4.2 Exhaustive knowledge of instrumentation for refractive surgery, including those used for advanced and complex cases

(This list provides guidance and is not complete. You may be asked about issues not listed here)

- Epithelium abrasion devices
- Microkeratomes
- Lasers for refractive surgery
- Topography-guided ablation, wavefront-guided ablation
- Instrumentation for refractive surgery

3.5 Exhaustive knowledge of the use of IOLs for appropriate refractive correction and outcomes

(This list provides guidance and is not complete. You may be asked about issues not listed here)

3.5.1 Biomaterial

- Types of IOL biomaterials
- Significance of the refractive index
- Filters (UV, blue light filters, others)

3.5.2 Design

- IOL shape
- IOL optical quality
  - Aberrations (spherical, chromatic, MTF and PSF)
  - Changes in biomaterial properties over time
- Lens design related to lens position:
  - lens-in-the-bag IOLs
  - iris fixated IOLs
  - sulcus fixated IOLs
  - scleral fixated IOLs
  - capsulotomy-supported IOLs
- Toric IOLs
  - pre- and postoperative evaluation of astigmatism (subjective and objective)
  - intraoperative alignment methods
- IOLs for presbyopia correction
  - Patient information and selection

  - Multifocal IOLs: refractive and diffractive
  - Extended depth of focus IOLs
  - Accommodative IOLs
  - Outcome assessment
- Magnifying IOLs

3.5.3 IOL calculation

- IOL calculation formulas
- Virgin eyes
- After refractive surgery
- Special cases
  - High ametropia
  - Irregular corneas
- Add-on and phakic IOLs
- Surgeon-induced astigmatism
- Refining surgeon's A-constant

3.5.4 IOL implantation in special cases

- Piggy Back implantation – Add-on IOLs
  - Primary implantation
  - Secondary implantation

- Implantation with weak or no capsular support
  - Ciliary sulcus fixation
  - Scleral fixated IOLs
  - Iris supported/sutured IOLs
  - Anterior angle-supported IOLs

- IOL explantation and exchange
  - IOL explantation
  - IOL exchange

- Cataract outcome enhancement
  - Incisional surgery
  - Laser procedures
  - Corneal inlays

- Cataract surgery in infants and young children
  - Types of congenital cataract
  - Consensus/controversies on:
    - measurement of ocular parameters
    - IOL calculation
    - visual rehabilitation
    - IOL implantation
    - IOL design

    - anterior vitrectomy

- Combined surgeries
    - Glaucoma and cataract
    - Vitreoretinal surgery and cataract
    - Keratoplasty (penetrating and lamellar) and cataract

3.6 Administration

Applicants should:

- be able to organize, run and continuously improve a successful and sustainable (cost-effective) care service for cataract and refractive surgery patients.
- have completed a Good Clinical Practice course.
- be able to evaluate cost effectiveness of cataract and refractive surgery screening, diagnosis, therapy and care processes in European countries.
- show understanding of the value of clinical audit in improving practice, including demonstration of a culture of personal appraisal.
- demonstrate appreciation of the importance of basic and clinical research in advancing knowledge and contributing to the evidence base.
- show recognition of the limits of your own knowledge and have insight into your own difficulty in understanding complex interactions.

4 Experience and self-study requirements

4.1 Literature:

Applicants must be able to demonstrate a current and ongoing attention to

- peer-reviewed literature
- important Randomized Controlled Clinical Trials in the field of cataract and refractive surgery
- critical appraisal studies for scientific, medical and clinical validity and importance
- systematic reviews from the last 5 years e.g. Cochrane reviews, Health Technology Assessments
- evidence based guidelines

4.2 Clinical exposure

Applicants must have adequate experience and be able to independently run a cataract and refractive surgery clinic, including the training of fellows.

Applicants must have performed at least 1,000 documented surgeries without supervision. Please note, the EBO-ESCRS Examination Board will also consider the number of surgeries completed in the past year in deciding whether to invite an applicant to sit the examination. The case mix should reflect some of the more advanced or rarer pathologies listed above.

Applicants must submit a video of a complex surgery they have performed without supervision. This should be one of their more challenging cases, and demonstrate their current surgical ability. This video should meet the following criteria (failure to do so will lead to rejection of the video and thus the application):

- MP4 format, of at least 800 x 600 resolution (1024 or better is preferred)
- Titled as follows: "LAST NAME_FIRST NAME_CASE TYPE.mp4"
- Maximum 5 minutes. Editing should not obscure or alter the core surgical procedure.
- The video must be the sole work of the candidate, and must state that this is the sole work of the candidate
- There must be no music, narration, or credits on the video
- No FLACS, the surgery must demonstrate your current manual skill set in a complex situation
- No patient-identifiable information should be included/ remain in the video.
- Surgery must include the following steps (which will be judged to determine suitable candidates for the examination):
    1. Incision
    2. Capsulorhexis
    3. Hydrodissection
    4. Nuclear disassembly
    5. Irrigation/aspiration
    6. IOL implant
    7. Closure
- The EBO-ESCRS Examination Board will also consider an overall impression of the surgery, as well as the quality of the video.

The applicant should also provide some (anonymised) case details using the CV/application form, including:

- Some patient/ case details (this was also requested by an examiner and a candidate)
- Why do you consider this procedure complex?

At all points in the application and examination process, applicants are responsible for ensuring data protection and appropriate patient confidentiality / consent issues are met relating to materials they submit.

4.3 Scientific activity

The minimum level of scientific activity consists of fluent skills in critical evaluation of literature. Participation in local, regional, national, or international professional and scientific meetings, eventually with active presentations at meetings and publications in peer-reviewed journals. It is desirable that the applicant has participated in basic and/or clinical research during his/her training.

5 Minimum Procedures and Confirmation

Surgeons should be actively auditing and collating their surgeries using an objective registry system (e.g. EUREQUO). A declaration of the surgeries completed without supervision is included in the EBO-ESCRS Examination Recommendation Letter (See Section 2.2, above).

The ESCRS reserve the right to audit an applicant's declared surgical experience, by requesting further details. This may be a registry report (e.g. EUREQUO, an EMS system, etc), accounts statement (IOLs implanted by the applicant) or an appropriately anonymised log book for the applicant.

5.1 Cataract Surgery Experience

Applicants must have completed 1,000 cataract surgeries without supervision. A proportion of these must include complex cases. The EBO-ESCRS Examination Board will also consider the number of surgeries completed in the past year.

5.2 Refractive Surgery Experience

Applicants must have observed refractive surgery, and be fluent with current procedures and approaches to refractive correction in a range of circumstances (including post-cataract surgery, post-keratoplasty, etc.)

Appendix

Prerequisites from residency training acquired prior to commencement of subspecialty training

Anatomy and physiology of the cornea and lens

Recommended reading to prepare for the subspecialty exam

Specific text books and reading material are not provided, as candidates are being asked to prove their expertise, which includes self-directed continuing medical education.

Candidates are expected to be informed of the latest developments in cataract and refractive surgery, with reference to peer reviewed literature, randomised controlled trials, meta analyses (e.g. Cochrane reviews), and also to be able to critically appraise the literature they read.

Courses from ESCRS Congress (or those of similar content and level) that may be of value to candidates include the following:

- Malpositioned lenses: optimal surgical management techniques
- Therapeutic corneal refractive surgery: achieving excellent outcomes in complications after LASIK or PRK
- IOL calculation after refractive surgery
- Managing cataract complications and complex cataract cases
- Toric IOLs and femto-LRIs: the planning process and what to do with refractive surprises…
- Strategies for very dense nuclei and other challenging and complicated cases
- Astigmatism evaluation and treatment: the current state of the art
- Achieving optimal cataract surgery outcomes in eyes with retinal disease or uveitis

- Collagen cross-linking: indications, applications, results, complications and evolving technology
- Overview of phakic IOLs
- Primary posterior capsulorhexis: indications and surgical techniques
- Endophthalmitis after cataract surgery and intravitreal injections
- IOL power calculation update by the IOL power club
- Anterior segment surgical solutions for secondary repair of post-traumatic eyes
- Astigmatism management with toric IOL
- Phaco techniques and complications
- Measuring, marking and managing astigmatism in cataract surgery and RLE: all you need to know
- Complications in LASIK: prevention and management
- Strategies and techniques for IOL exchange
- Comprehensive anterior segment evaluation for cataract and refractive surgery (incl. biometry, axial length measurement and IOL calculation using Scheimpflug technology)
- Ocular trauma assessment and management
- ReLEx SMILE: scientific summary and surgical tips and pearls
- Intraocular suturing
- Management of paediatric cataracts
- Correcting presbyopia using corneal inlay technologies

eLearning content. The following UEMS-accredited courses (or equivalent from other providers) are recommended:

- ESCRS iLearn: Visual Optics Suite (Visual Optics, Visual Function, Imaging the Human Eye)
- ESCRS iLearn: Endophthalmitis
- ESCRS iLearn: IOL Power Calculations after Refractive Surgery

Relevant randomized controlled clinical trials for cataract and refractive surgery

Study	Reference
Multicenter randomized controlled clinical trial in paediatric cataract surgery: efficacy and effectiveness	Wilson ME, Trivedi RH. Am J Ophthalmol. 2007 Oct;144(4):616-7. DOI: http://dx.doi.org/10.1016/j.ajo.2007.06.033
Results of the Endophthalmitis Vitrectomy Study. A randomized trial of immediate vitrectomy and intravenous antibiotics for the treatment of postoperative bacterial endophthalmitis.	Endophthalmitis Vitrectomy Study Group. Arch Ophthalmol 1995;113:1479-96. DOI: http://dx.doi.org/10.1001/archopht.1995.01100120009001
ESCRS study of prophylaxis of postoperative endophthalmitis after cataract surgery: preliminary report of principal results from a European multicenter study.	Barry P, Seal DV, Gettinby G et al. J Cataract Refract Surg 2006;32:407-10 DOI: http://dx.doi.org/10.1016/j.jcrs.2006.02.021

Study	Reference
Multifocal versus monofocal intraocular lenses after cataract extraction.	Leyland M, Pringle E. Cochrane Database Rev 2006, Issue 4. Art No.:CD003169 DOI: http://dx.doi.org/10.1002/14651858.CD003169.pub2
Safety of overnight orthokeratology for myopia: a report by the American Academy of Ophthalmology.	Van Meter WS, Musch DC, Jacobs DS, et al. Ophthalmology 2008;115:2301-13 DOI: http://dx.doi.org/10.1016/j.ophtha.2008.06.034
A randomized trial of rigid gas permeable contact lenses to reduce progression of children's myopia.	Katz J, Schein OD, Levy B, et al. Am J Ophthalmol 2003;136:82-90 DOI: http://dx.doi.org/10.1016/S0002-9394(03)00106-5