



ECOO Guidelines for Optometric and Optical Services in Europe

June 2013

EXECUTIVE SUMMARY

The European Council of Optometry and Optics (ECOO) has developed guidelines for optometric and optical services in Europe. The aim is to establish consistent guidance on the quality of service provision that the public should expect when accessing eye care services. ECOO representatives across several countries contributed to the development of the guidelines.

Note: Given the variation in healthcare systems across Europe, national regulation and national guidelines for eye care will take precedence over the contents of this document.

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1 INTRODUCTION

These guidelines for optometric and optical services in Europe address the need to establish consistent guidance on the quality of service provision that should be expected by the public when accessing eye care services.

Certain aspects of optometric and optical eye care service delivery may be encompassed by national regulations and existing national standards, and it is recognised that the guidelines may not reflect national legislative requirements in member countries. However, while national regulations will take precedence over any European guidance, the guidelines should provide direction regarding the quality of service provision for eye care services. They also complement the World Council of Optometry statement on a global model for optometry.

The term 'primary eye care' is commonly used to refer to eye care in the community that is the first point of contact for members of the public. Primary eye care should consider all the population, be responsive to local needs, and must be accessible, appropriate, and affordable. In addition, a good primary eye care model requires providers to work closely with other health care professionals to ensure that patients have access to an integrated healthcare service.

Primary eye care services may include:

- Promoting eye health and educating the public
- Comprehensive assessment of the visual system
- Detection and recognition of ocular pathology signs and symptoms
- Measuring refractive error
- Prescribing and fitting optical aids such as spectacles, contact lenses and low vision aids
- Managing eye care needs
- Referral and coordination of care with medical and other professions

Glaucoma, age-related macular degeneration, diabetic retinopathy and cataract are the most common causes of visual impairment in Europe. The risk of visual impairment substantially increases with age, and is associated with reduced quality of life. With the ageing European population, effective primary eye care services are imperative to tackle avoidable sight loss.

European legislation increasingly reflects the need to facilitate the movement of healthcare professionals to different countries within Europe. This and other legislation requires a good understanding of what services are delivered within primary eye care. This document sets out the expected quality of eye care service provision in Europe for the general public. For those with a disability or with existing pathology, the service required may be beyond the scope of these guidelines.

2 TERMS AND DEFINITIONS

In Europe, there are several terms used to describe professionals providing eye care services to the community, such as ophthalmologist, optometrist, optician, augenoptikemeister and optico-optometrista. While different countries may use different terminology, the professional providing eye care and the nature of an eye examination should be broadly equivalent, so the current document uses the term eye care practitioner rather than a specific professional term.

In this context, these guidelines apply to optometrists and opticians only.

Annex 1 provides a glossary of terms and definitions for commonly used words and phrases within this document.

3 SERVICE FRAMEWORK

3.1 GENERAL

3.1.1 *Education*

An eye care practitioner will hold qualifications recognised by his/her national laws and regulations concerning the delivery of eye care. These qualifications should correspond to point (d) article 11 of the EC Directive 2005/36/EC. Accordingly, an eye care practitioner will normally have a Bachelor of Science from a recognised educational institution, although older professionals may have more historic national qualifications, and for some countries a Master of Science is the standard education level. ECOO has created the European Diploma in Optometry, the syllabus for which is regarded as a European standard for optometric education (Annex 2).

In addition, there is a culture of postgraduate education and a strong academic and research history in optics and vision science, ensuring that eye care practitioners are educated with an understanding of evidence-based practice.

Eye care practitioners in primary care usually come from two main backgrounds: optometry or opticianry. In many countries in Europe the training and roles of an optician and optometrist are converging, and education is being upgraded to develop expertise in ocular disease, while in other countries the professions are still distinct.

Eye care practitioners will usually be registered with or recognised by a professional/regulatory body in their country, and will follow a code of practice and ethical requirements. Eye care practitioners should only practise within their sphere of competence.

3.1.2 *Facilities*

Eye care services are normally delivered in a location with facilities such as a reception and waiting area, and a private room for consultations and assessment. The private consulting room should be of a sufficient size and appropriately illuminated to perform the elements of an eye examination, including the measurement of visual acuity. The clinical area will be kept clean, with strict hygiene measures in place, and hand-washing facilities must be available.

3.1.3 *Equipment*

An eye care practitioner will have the equipment necessary to provide optometric and/or optical services. This will include an accurate means of measuring visual acuity, assessment of visual and binocular function, assessment of objective and subjective refraction, and examination and assessment of ocular health. When optical services are provided, the practice will also have equipment necessary for dispensing optical appliances. Practices will normally have a selection of optical appliances, including spectacle frames and contact lenses, in order to fulfil the prescription and dispense an optical appliance.

Many national professional optometric and optical associations provide guidance on the appropriate equipment necessary to undertake eye care services.

All new or recently supplied equipment will be CE marked, and equipment should be verified and calibrated in accordance with the manufacturer's guidelines. Many items of equipment will be covered by the European Medical Devices Directive.

3.1.4 *Public/patient information*

Providing eye care services requires eye care practitioners to use their knowledge and skills for the benefit of the patient. Patients should be treated with courtesy and tact, and eye care practitioners should be sensitive to their medical, psychological and emotional needs. Verbal and written advice and information to the public may be provided and it should be appropriate and scientifically based.

Countries will have different regulations regarding advertising and promotion of services, and eye care service providers should act in accordance with the rules of the country in which they practise.

Eye care service providers should not try to attract patients by means of inappropriate incentives or gifts.

4 THE PROCESS

4.1 GENERAL

A patient attending for an eye examination may have scheduled an appointment or may pay a spontaneous visit. There may be a number of reasons why the patient wishes to have an eye examination and the eye care practitioner will be responsive to this. The process of the eye examination should be made clear to them.

An eye examination will be recorded in written or electronic form such that it is a confidential record of the examination of the patient and complies with current data protection legislation.

4.2 CLIENT/PATIENT CONTACT

The patient's first face-to-face contact will usually be at the reception area and the patient's demographic details will be recorded.

4.3 THE CONSULTATION

The eye examination should encompass the eye care status and needs of the patient, and provide a full assessment of refractive and visual status. Patients may also wish to have a contact lens assessment. A contact lens assessment may occur in conjunction with an eye examination or be undertaken at a separate visit.

Many national optometric and optical professional bodies in European countries have guidelines relating to requirements of a consultation. Briefly, depending on the individual patient's needs, an eye examination will generally consist of the following elements:

4.3.1 *Medical and ocular history and symptoms*

The patient will be asked structured questions relating to the reason or reasons for the visit, his/her own and family medical and ocular history, discussion of refractive needs, and any symptoms he/she may have.

4.3.2 *An assessment of visual acuity*

Visual acuity for distant and near vision will be measured monocularly and binocularly with a standardised appropriate visual acuity chart which contains high contrast optotypes. Visual acuity will usually be measured for uncorrected and corrected vision.

4.3.3 *Refraction of the eye such that a prescription is established*

The distance refractive error of each eye will be measured to provide an accurate evaluation of the spectacle prescription or contact lens specification for the patient. This will include determining the optimal spherical and cylindrical combination to correct refractive error. Refraction is typically carried out using a combination of objective and subjective techniques. Where relevant, for presbyopes, near refractive correction for closer working distances will also be measured.

On occasion, and if it is in the patient's interests, non-presbyopic patients may be prescribed a near addition (e.g. in cases where there is accommodative insufficiency or a binocular vision problem). There may be a clinical reason for patients being prescribed a tint. Others may have special modifications made that allow optimal vision correction for specific needs (e.g. occupational needs or hobbies). In any case where such modifications are made the record and prescription should document these clearly.

4.3.4 *Assessment of the binocular status of the eye*

A battery of tests determining the ability of the eyes to 'work together' to view targets at distance and near and in different positions will typically be conducted to gain information regarding the quality of the eyes' binocular status (oculomotor balance), ocular motility, and ability to converge to a near target.

4.3.5 *Assessment of visual function status*

A number of other tests may be conducted including measurement of the accommodative ability of the eyes, pupil reactions, and assessment of visual fields. Other tests such as tonometry and keratometry may be conducted depending on the patient's needs.

4.3.6 *Assessment of the ocular health of the eye*

External and internal examination of the eyes will typically be conducted. This may be referred to as examination of the anterior and posterior segment of the eyes. There is a wide variety of techniques the eye care practitioner may employ (including slit lamp examination and use of supplementary lenses, direct and indirect ophthalmoscopy – monocular and binocular, fundus photography, ocular coherence tomography), all of which use an illumination and magnification system to examine the eye in detail.

4.3.7 *A record of the results*

The eye care practitioner will keep a complete and accurate record of the procedures and outcomes of the examination. These records are confidential and should conform to data protection legislation.

4.3.8 *Prescribing and fitting optical appliances, i.e. spectacles, contact lenses, low vision aids*

Accurate measurement and assessment of inter-pupillary distance, back vertex distance and other eye and facial measurements will be conducted to ensure optimal fitting of optical appliances (see Section 4.5).

4.3.9 *Patient education regarding the results of the examination*

The outcomes of the examination will be discussed with the patient, including explanation of his/her refractive needs and management advice.

4.3.10 *Issuing advice and management and the prescription*

Advice and appropriate management will be discussed with the patient, and documented on the patient record. The patient will usually be given a written copy of his/her refractive prescription.

4.4 OUTCOMES OF THE CONSULTATION

4.4.1 *The prescription*

A patient is usually given written information incorporating his/her refractive prescription. This should normally include:

The spectacle prescription:

- Patient name, address and date of birth
- Power of spectacle correction required. This will include parameters such as: the spherical power, cylindrical components, axis, prismatic correction and near addition
- Date and time limit of the prescription
- Contact details of the prescribing eye care practitioner
- Signature of the prescribing eye care practitioner
- In some countries the eye care practitioner will have a registration number and this may be included

The contact lens specification may include:

- Patient name, address and date of birth
- Contact lens specification, including: the lens material and/or manufacturer, the spherical power, any cylindrical component and axis, the total diameter, and the back optic zone radius
- Prescribed contact lens care products and rewetting drops (where applicable)
- Wearing schedule
- Date and time limit of the specification
- Contact details of the prescribing eye care practitioner
- Signature of the prescribing eye care practitioner
- In some countries the eye care practitioner will have a registration number and this may be included

4.4.2 *Management – professional advice*

After examination, the patient will be provided with advice regarding his/her refractive status, the need for refractive correction, ocular health, any referrals that may be necessary (see section 4.4.4) and when he/she should next be seen for an examination.

4.4.3 *Record keeping*

Procedures should be in place to capture all patient contacts. The record of examination will include patient details, date of examination, medical and ocular history, refractive assessment and prescription, visual acuity, examination of ocular health and other visual functional measurements. It will also document the management plan for the patient, and recommended testing interval. The record should use conventional terminology for recording measurements and be legible.

Increasingly, eye care service providers may use electronic record keeping systems. While these can be advantageous, this does give rise to additional burdens including the need to have plans in place to ensure records can be recovered and all patient contacts tracked.

Furthermore, a mix of electronic and paper recording systems can be potentially confusing and is inadvisable.

4.4.4 Referral

If the eye examination has uncovered ocular or medical pathology that requires onward referral to another health professional, the eye care practitioner will write a referral describing the nature of the ocular or medical pathology. The practitioner will determine the urgency of the referral, identify the appropriate health professional to refer to, and inform and advise the patient about the nature and significance of the referral.

4.4.5 Follow up

The patient should be advised of the appropriate testing interval. For many patients, eye examinations should be on a yearly or bi-yearly basis. However, the eye care practitioner may wish to advise a shorter test interval in specific cases.

4.4.6 Contact lens aftercare

Where contact lenses are fitted as the medical refractive device, contact lens aftercare appointments are important to monitor eye health and patient compliance with professional advice regarding the wearing schedule of the contact lenses and lens care procedures. Aftercare appointments tend to be regularly staged in six-monthly or annual intervals but may occur more frequently in specific cases.

4.5 DISPENSING OF OPTICAL APPLIANCES

4.5.1 Manufacture of spectacles

Spectacles may be assembled directly by the eye care service provider or obtained from a supplier of spectacles. They should comply with European and International Standards on optical appliances and medical products. There are numerous European and ISO standards for spectacle lenses, frames, spectacles, personal protective eyewear, contact lenses and low vision aids.

The Medical Devices Regulations 2002 (SI 2002 No 618) implement the Medical Devices Directive 93/42/EEC. The regulations cover a broad range of products and activities, including ophthalmic appliances, instruments and equipment. They also cover spectacle glazing and surfacing. Glazing includes the assembly of edged lenses into a new spectacle frame.

4.5.2 Dispensing

As part of optometric and optical services, the eye care practitioner will usually fit and supply optical appliances. Optical appliances include spectacles, contact lenses and low visual aids.

There are several elements comprising an appropriate dispense:

- The interpretation of refractive prescriptions
- Choosing the appropriate optical appliance
- Advising patients on appliances
- Manufacture/construction of frames and corrective lenses

- Verification of optical appliances in accordance with International Standards for optical tolerances.
- Fitting of spectacles
- Fitting of contact lenses

The patient should receive professional advice on the most appropriate optical and cosmetic choice of lens type. This requires careful interpretation of the prescription, and knowledge of the patient's refractive needs, occupation and lifestyle. The choice of lens can be a complex issue, and requires specialised knowledge and skills to ensure that the dispensing is optimum.

There are many measurements necessary to accurately fit the optical appliance with the prescribed refractive correction. The patient should have these measured as part of routine eye care services.

For spectacle lenses, this will typically include the measurement of inter-pupillary distance, pantoscopic tilt, back vertex distance and other facial and frame measurements. The fitting should comply with the relevant standards and ensure that the lenses are fitted to the correct spectacle plane and height, with appropriate centration. Spectacle frames should be adjusted to ensure optimum fitting with the spectacles in the correct position for the wearer.

For contact lenses, fitting will normally require keratometry readings, horizontal vertical iris diameter, vertical palpebral aperture and pupil size. The device will need to be verified against the contact lens specification, and the appropriate number of contact lenses given. If contact lenses require storage/cleaning solutions, the eye care practitioner will advise on the appropriate care system. The lenses will be clearly labelled according to the patient's left and right eye specification.

4.5.3 *Record keeping*

The nature of the optical appliance should be recorded in the patient record including the measurements necessary to fit the appliance. How the appliance is to be used should be indicated on the record.

Spectacles: information on the spectacle make and model, and the lens material and optical design should be recorded.

Contact lenses: information on the contact lens parameters should be recorded.

Low vision aids: information on the magnification, and the model of the appliance and illumination should be recorded.

5 OTHER SERVICES

5.1 EMERGENCY/ACUTE SERVICES

Eye care service providers may deliver emergency or acute services, outside that of a routine eye examination, where examination is targeted to manage, advise and/or treat and manage the patient according to the clinical findings of the acute examination. This may include onward referral to a medical specialist. Where an eye care practitioner has the scope of practice and expertise to provide these services they should have the appropriate equipment to examine the ocular adnexa.

5.2 ADDITIONAL EYE CARE SERVICES

Subject to national legislation and competences, additional specialised eye care services may be provided. These may include:

Low vision services: a patient will be managed and given advice on appropriate optical appliances such as low vision aids and magnifiers. Lifestyle changes will be discussed and other social services professionals will often be involved to help the patient in their daily living, which may be affected by low vision.

Binocular vision: the patient will have binocular vision dysfunction assessed, managed and treated accordingly. Management may include ocular exercises, refractive correction and other techniques/devices which promote stable binocular vision.

Therapeutics: an eye care practitioner may have the scope of practice to treat ocular conditions, with the ability to prescribe therapeutic drugs or therapeutic contact lenses. He/she will have advanced knowledge and skills to examine the ocular components of the eye to detect disease, and effectively treat and manage ocular conditions therapeutically.

Paediatrics: an eye care practitioner will provide an age-appropriate examination of a child's eyes and vision. Particularly for young children, the principal aim is to identify those whose visual development deviates from the normal patterns, those who require spectacle correction, or who have, or are at risk of, developing amblyopia or strabismus. Obtaining monocular visual acuity measurements using the best technique possible for the child's age is important. Other measures may require more objective techniques for children than adults. In some countries eye care service providers may be responsible for childhood national vision screening programmes to detect amblyopia.

Vision testing for driving a vehicle: an eye care practitioner will assess the patient for the relevant vision driving standards for his/her country. The EC Directive on Driving Licences 2006/126/EC amended by Directive 2009/113/EC Annex III sets out comprehensive visual standards for driving. However, the implementation of this directive has differed across countries. Some countries have not changed their requirements and such visual assessments for driving will only include an assessment of vision, and a measurement of the extent of the patient's visual field. However, some European countries have implemented the directive more fully and require evidence of assessment of contrast sensitivity, glare sensitivity, and diplopia. Despite these country differences, the eye care practitioner will discuss the quality of the

patient's vision for driving, whether a refractive correction is required when driving, and other relevant aspects of his/her vision pertinent to driving. The patient may require the eye care service provider to complete a report on the patient's visual standard for driving.

Occupational vision testing: the patient will be assessed and advised on the appropriate visual requirements for his/her occupation. Where necessary, relevant occupational standards for visual requirements will be consulted. This may include information regarding aspects of vision such as visual acuity, refractive error, binocularity, and colour vision. For many patients, even without specific occupational requirements, computer use is a fundamental aspect of their work, and the practitioner will advise on workstation lighting, set-up, viewing distance and refractive correction.

Sports vision: the patient will have aspects of vision particularly relevant for sports, such as dynamic visual acuity assessed. They will be advised on an appropriate refractive correction and may be prescribed a vision therapy programme to optimise visual skills. They will also be advised on appropriate eye protection and protection from excessive sunlight and UV light.

Dry eye assessment: an eye care practitioner may have expertise to examine and manage the condition of dry eye or ocular surface disorders. The eye care practitioner may use a number of treatments including ocular lubricants and punctum plugs.

Domiciliary services: an eye care practitioner may provide eye care services in a patient's home or an environment other than a clinical practice in cases where the patient is unable to attend for eye care services outside of his/her home. In such cases, the eye care practitioner should have suitable portable equipment to provide a comprehensive examination outside of clinical practice.

Diabetic retinal screening: patients with diabetes are at increased risk of retinal vascular problems, and consequent visual loss. In some countries, national screening programmes exist to opportunistically examine the retina for diabetic retinopathy. Eye care services may be involved in retinal screening of diabetics, the nature of which will depend on the content of the national screening programme.

Referral refinement for glaucoma: glaucoma has an estimated prevalence of 2% in the general population, which increases with age. However, it is asymptomatic in its early/moderate stages, and has a range of presenting features which can be subtle or change slowly over time. Primary eye care practitioners are well placed to check for the presence of any glaucomatous changes, and will do so in routine practice. However, in some countries, eye care practitioners may be involved in bespoke schemes to help refine the detection of glaucoma. In such cases they will employ specific clinical techniques and may repeat measurements on more than one occasion to better detect this challenging eye disease.

5.3 FAULTS/REPAIRS

Eye care service providers will commonly perform maintenance and repairs on optical appliances and should ensure that they manage these appropriately.

5.4 COMPLAINTS

Eye care service providers should facilitate the hearing and recording of patients' complaints and should attempt to resolve all complaints either verbally or in writing in a prompt manner. Some countries in Europe may have additional consumer rights groups and organisations to facilitate the process and help patients with complaints.

5.5 PUBLIC HEALTH PROMOTION

Optometric and optical service providers are ideally located to be primary eye care providers in the community and give advice to the public on visual health. There are many opportunities to promote public health messages and educate the public on eye care matters. Eye care service providers should seek to encourage and foster an environment of public health promotion in their communities.

In addition to public health concerns in their home country, many eye care service providers are involved in developing and promoting eye care in developing countries. One such example is the Vision 2020 global initiative to ensure avoidable blindness is eliminated by the year 2020. This is a joint programme of the World Health Organisation and the International Agency for the Prevention of Blindness and many professional associations and NGOs in Europe are actively involved in the initiative.

ANNEXES

ANNEX 1 Glossary of terms

Binocular vision: vision that results from the combined input from the two eyes which provides wider visual fields, increased depth perception (stereopsis) and enhanced performance (known as binocular summation) when fusion of retinal images is achieved. Binocular vision anomalies may lead to a series of binocular stress symptoms, such as eyestrain, headaches and double vision.

Contact lens practitioner: an optometrist or dispensing optician who has received special training to fit contact lenses for the correction of refractive error and the management of keratoconus and other corneal pathologies.

Contact lens: a lens placed on the eye during the day to correct refractive error or for cosmetic and therapeutic reasons, e.g. to manage corneal diseases such as keratoconus.

Dispensing optician: a practitioner who verifies fits and supplies ophthalmic appliances (e.g. lenses, prisms, spectacles) that cater to each patient's visual and vocational needs. Some specially trained (registered or licensed) opticians also fit contact lenses and dispense low vision aids.

Eye care practitioner: a health care practitioner involved in eye care, from one with a small amount of post-secondary training to a medical specialist, i.e. dispensing opticians, optometrists and ophthalmologists.

Low vision: the condition in which vision cannot be corrected to normal levels by spectacles or contact lenses, leading to visual impairment. Severity of low vision is classified by the WHO (World Health Organization) based on visual acuity and visual field loss criteria.

Ocular pathology: any abnormal condition in the eye that causes dysfunction in the visual process and reduces visual performance.

Ophthalmologist: a medical specialist of the eye who can also use a range of surgical approaches or other therapeutic interventions for the treatment and management of ocular pathologies.

Optical appliances: ophthalmic appliances, such as contact lenses and spectacles, used for the correction of refractive error or for the management of vision in partially sighted individuals (known as low vision aids).

Optometrist: 'a primary health care practitioner of the eye and visual system who provides comprehensive eye and vision care, which includes refraction and dispensing, detection/diagnosis and management of disease in the eye, and the rehabilitation of conditions of the visual system' (definition from World Council of Optometry's concept of optometry).

Patient: a member of the public attending for an eye examination or consultation with an eye care practitioner.

Presbyopia: an age-related condition characterised by gradual loss of accommodative ability to the point where it becomes insufficient for the daily needs of near (and intermediate) vision.

Prescription: the refractive correction of the patient. Refractive prescriptions are written in a conventional recognised format comprising the spherical and astigmatic (where present) components of the spectacle prescription (or contact lens prescription, referred to as the specification).

Refractive error: the condition in which parallel (distant) rays of lights are not focused on the retina, causing a blurred retinal image. This is usually the result of a deviation in the growth of the eye, and results in hyperopia (long-sightedness, or myopia (short-sightedness). Astigmatism can also occur in conjunction with hyperopia or myopia and this is a deviation from the spherical shape of the eye.

Vision therapy: a sequence of standardised tests (e.g. lenses, prisms, filters, exercises, computer programs) individually prescribed and monitored by the eye care practitioner to treat diagnosed conditions of the visual system (such as accommodative and vergence anomalies) and to develop efficient visual skills.

Visual acuity: the preferred test and standard procedure to assess the integrity of visual function and refine refraction. It comprises one of the main criteria that define, internationally, visual “fitness” for driving a vehicle, and visual “readiness” for many occupations, such as for aircraft pilots.

ANNEX 2 ECOO European Diploma Syllabus

European Diploma in Optometry *The New Syllabus (January 2007)*

Part A: Optics and Optical Appliances

Subject 1: Geometrical Optics

Subject 2: Physical Optics

Subject 3: Visual Optics

Subject 4: Optical Appliances

Subject 5: Occupational Optics

Part B: Clinical Investigation and Management

Subject 6: Vision and Ageing

Subject 7: Refraction

Subject 8: Low Vision

Subject 9: Ocular Motility and Binocular Vision

Subject 10: Contact Lenses

Subject 11: Investigative Techniques

Subject 12: Paediatric Optometry

Subject 13: Refractive surgery

Part C: Biological and Medical Sciences

Subject 14: Visual Perception

Subject 15: Anatomy and Histology

Subject 16: Neuroscience

Subject 17: General Physiology and Biochemistry

Subject 18: General Microbiology and Immunology

Subject 19: General Pharmacology

Subject 20: Pathology and General Medical Disorders

Subject 21: Epidemiology and Biostatistics

Subject 22: Ocular Anatomy and Physiology

Subject 23: Ocular Pharmacology

Subject 24: Abnormal Ocular Conditions

Part A: Optics and Optical Appliances

Subject 1: Geometrical Optics

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into geometrical optics in order for the candidate to be able to understand and solve problems related to the eye and optical instruments/lenses, their function and correction. Knowledge and understanding should be demonstrated in the areas of: (1) refraction at single spherical or plane surfaces, (2) thin lenses, (3) thick lenses, (4) aberrations, (5) apertures, (6) spherocylindrical lenses, (7) thin prisms, (8) mirrors, and (9) ophthalmic and optical instruments.

The aim is to achieve knowledge of the fundamentals of geometrical optics and how they apply to the human eye.

Subject 2: Physical Optics

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into physical optics in order for the candidate to be able to understand and solve problems related to the eye and optical instruments/lenses, their function and correction. Knowledge and understanding should be demonstrated in the areas of: (1) wave optics, (2) interaction of light on matter, (3) polarisation, (4) transmission through successive (4) polarisers, and (5) image quality.

The aim is to achieve knowledge of the fundamentals of physical optics and how they apply to the human eye.

Subject 3: Visual Optics

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into visual optics in order for the candidate to be able to understand and solve problems related to image formation, both qualitative and quantitative, for the candidate to investigate the optics of the human visual system and refractive correction. Knowledge and understanding should be demonstrated in the areas of: (1) schematic eye models, (2) dioptrics of the eye, (3) entopic phenomena, (4) quality of retinal image, and (5) radiation and the eye.

Subject 4: Optical Appliances

Learning outcomes:

The candidates should demonstrate knowledge and skills of optical appliances and dispensing and how visual correction interacts with the eye. Knowledge and skills should be demonstrated in the areas of: (1) physical characteristics of ophthalmic lenses, (2) optical characteristics of ophthalmic lenses, (3) ophthalmic prisms and prismatic effect of lenses, (4) multifocal lenses, (5) physical characteristics and biological compatibility of frame materials, (6) specification and nomenclature of spectacle frame components, (7) optical and spectacle frame considerations of high-powered lenses, (8) spectacle magnification, (9) absorptive lenses, (10) impact resistance, (11) optical tolerances and physical requirements of ophthalmic lenses and frame materials (EN), and (12) spectacle applications.

Subject 5: Occupational Optics

Learning outcomes:

The candidates should demonstrate knowledge and understanding and be able to discuss and test visual function in relation occupational optics. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) visual performance, (2) ocular injuries, (3) eye protection and its regulations, (4) lamps and lighting, and regulations regarding lighting, (5) visual display units, and (6) regulations related to vision and driving.

Part B: Clinical Investigation and Management

Subject 6: Vision and Ageing

Learning outcomes:

The candidates should demonstrate knowledge and understanding and be able to discuss, test and explain the human development of the visual system and its response to ageing. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) normal vision development in the infant and child, (2) normal motor development in the infant and child, (3) normal cognitive and social development in the infant and child, (4) effects of early environmental

restrictions, (5) normal changes in vision with ageing, (6) anomalies of child development, (7) clinical techniques and tests to assess the development of children at various ages, (8) clinical characteristics of children who deviate from normal patterns of development, and epidemiology of developmental disorders (9) tests that diagnose vision problems which may be associated with deviations from normal patterns of development, (10) tests used by optometrists to determine a child's level of visual-perceptual development, (11) role of the optometrist and other disciplines in screening, evaluating, managing and referring children who deviate from normal patterns of development, (12) anomalies of the ageing adult, (13) clinical characteristics of changes in perceptual function (non-visual) associated with ageing, (14) symptom profiles, clinical procedures, and tests identifying changes in vision, (15) clinical management of ageing patients with multisensory loss, (16) assessment of the need for referral and consultation with other disciplines, (17) colour vision anomalies by type and prevalence, (18) colour vision tests used for both screening and diagnosis of congenital colour vision anomalies, (19) conditions for colour vision testing, (20) societal implications of colour vision anomalies, and (21) assessment of the need for referral and consultation with other disciplines.

Subject 7: Refraction

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and refract patients in the most suitable way. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) different refractive states of the eye, (2) mechanisms of presbyopia, (3) anamnesis, (4) preliminary testing, (5) objective static and dynamic refractive status, including automatic refractive devices, (6) standard subjective refraction procedures, including astigmatic dials, crossed cylinders, stenopaic slit, fogging methods and equalisation (duochrome) techniques, (7) binocular subjective refraction procedures, including accommodation binocular balancing methods, (8) binocular subjective refraction procedures, including accommodation binocular balancing methods, (9) cycloplegic subjective and objective techniques, (10) automatic computer-assisted subjective procedures, laser refraction and variations in procedures for the various ametropias, (11) identification, treatment and management using spectacle and contact lenses, and prognosis, and (12) observation and recognition of clinical signs, and techniques and skills for determining the near add.

Subject 8: Low Vision

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage patients whose vision cannot be improved significantly using conventional spectacles or contact lenses, in order to make the most of their residual vision using magnifying systems and imaging technology. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) definitions and regulations of low vision, (2) incidence and causes, (3) measurement of visual performance, (4) magnification, non-optical aids, (6) illumination and lighting, (7) aids for peripheral field, (8) eccentric viewing and steady-eye strategy, (9) environmental modification, and (10) clinical procedures.

Subject 9: Ocular Motility and Binocular Vision

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage patients who suffer from binocular vision problems and who are at risk of developing binocular vision problems. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) nature of binocular vision anomalies, (2) binocular vision routine examination, (3) examination of young children, (4) evaluation and management of heterophoria, (5) evaluation and management of heterotropia (strabismus), and (6) examination and management of incomitant deviations and nystagmus.

Subject 10: Contact Lenses

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and undertake examinations and management of patients wanting to wear or who are already wearing contact lenses. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) treatment and management of refractive/oculomotor/sensory integrative conditions using contact lenses, (2) lens types and materials: hard lenses; haptics; lathe-cut, moulded, and spincast soft lenses, (3) optics of contact lenses: curves, zones, widths and tear lens effects, sagittal depth; centre and edge thickness; flex, asphericity, toric designs and quadrant specific designs, and oblate geometries with reverse curves, (4) theories and methods of fitting: lens design, specifications of orders, lens verification and evaluation, insertion and removal techniques, design of wearing schedules, fluorescein evaluation and fitting criteria, (5) patient selection based upon history, analysis of primary care data, correlations of data, facial

physiognomy, and contraindications; and management based upon education, and patient handling and control, (6) the examination of a new prospective contact lens patient, the anterior segment examination and measurement, (7) contact lens selection from presently available types and forms of lenses, (8) care of lenses; handling; cleaning; preservatives available; disinfection methods and solutions, (9) follow-up care; adaptation, physiologic and post-fitting complications, allergic responses, lens changes and mechanical problems, (10) bifocal and astigmatic contact lenses; types, basis of selection and adaptation, techniques of fitting, and care for each, (11) specially designed lenses and fitting procedures for keratoconus and irregular corneas, for keratoplastic and after refractive surgeries, sports vision, diseased and traumatic corneas, cosmetic (prosthetic) use, iris colour changes and colour vision deficiencies, (12) specially designed lenses and fitting procedures for orthokeratology, and (13) parameter modification in theory and practice.

Subject 11: Investigative Techniques

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and undertake examinations of patients using investigative techniques. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) colour vision investigation, (2) keratometry, (3) retinoscopy, (4) automatic objective refraction, (5) slit lamp examination of the external and internal eye, (6) tonometry (contact and non-contact), (7) direct ophthalmoscopy, (8) monocular indirect ophthalmoscopy, (9) binocular indirect ophthalmoscopy, (10) gonioscopy, (11) lacrimal system evaluation, (12) fundus biomicroscopy, and (13) quantitative perimetry.

Subject 12: Paediatric Optometry

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage children in an optometric setting. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) paediatric communication skills, (2) assessment of visual acuity, (3) refractive examination, (4) myopia, (5) binocular vision disorders, (6) paediatric eye disorders, (7) spectacle dispensing, (8) contact lenses, and (9) low vision assessment and management.

Subject 13: Refractive Surgery

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and undertake examinations and management of patients wanting to undergo or who have undergone refractive surgery. Knowledge, understanding and testing skills should be demonstrated in the areas of patient counselling and pre- and postoperative assessments. Knowledge and understanding should be demonstrated in the different treatment options and postoperative complications.

Part C: Biological and Medical Sciences

Subject 14: Visual Perception

Learning outcomes:

The candidates should demonstrate knowledge and understanding of the physical and physiological aspects of vision including the principles of psychophysical measurements, visual detection, visual discrimination, visual search and attention, and binocular vision. Knowledge and understanding should be demonstrated in the areas of: (1) visual pathway, (2) colour vision, (3) space perception, (4) form perception, (5) light perception, (6) motion perception, (7) temporal perception, (8) basic psychophysical methods and theory, (9) psychophysical scaling methods and theory, and (10) signal detection methods and theory.

Subject 15: Anatomy and Histology

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into general anatomy and histology. Knowledge and understanding should be demonstrated in the areas of: (1) head and skull (muscles, arteries, veins, lymphs, cranial nerves, sinuses, vestibular system), (2) cells (membranes, compartments, organelles, stem cells, cell differentiation), and (3) tissues (epithelium, glands, connective tissue, muscle, blood, nerves).

Subject 16: Neuroscience*Learning outcomes:*

The candidates should demonstrate fundamental knowledge and insight into the area of neuroscience. Knowledge and understanding should be demonstrated in the areas of: (1) electrophysiology of the nerve cells (resting and action potential, synapses, receptors), (2) neuro-anatomy (brain, cranial nerves, spinal cord, autonomic nervous system), and (3) neurophysiology (reflexes, pain and sensation, vestibular system, proprioceptive sensation, autonomic nervous system).

Subject 17: General Physiology and Biochemistry*Learning outcomes:*

The candidates should demonstrate fundamental knowledge and insight into physiology and biochemistry. Knowledge and understanding should be demonstrated in the areas of: (1) respiration, (2) gastrointestinal activity, (3) muscles, (4) body fluids, (5) renal system, (6) circulatory system, (7) endocrine system, (8) proteins, (9) carbohydrates, (10) lipids, (11) molecular biology, and (12) bioenergetics.

Subject 18: General Microbiology and Immunology*Learning outcomes:*

The candidates should demonstrate fundamental knowledge and insight into general microbiology and immunology. Knowledge and understanding should be demonstrated in the areas of: (1) virology, (2) bacteriology, (3) mycology, (4) parasitology, (5) antigens and antibodies, (6) complement system, (7) non-specific immunity, (8) specific immunity, (9) hypersensitivity response, and (10) autoimmunity.

Subject 19: General Pharmacology*Learning outcomes:*

The candidates should demonstrate fundamental knowledge and insight into general pharmacology. Knowledge and understanding should be demonstrated in the areas of: (1) pharmacokinetics, (2) pharmacodynamics, (3) drugs acting on the autonomic nervous system, (4) analgesics and local anaesthetics, (5) antipyretics and anti-inflammatory drugs, (6) antibiotics, (7) antiviral drugs, (8) anti-allergic drugs, (9) drugs affecting respiratory and cardiovascular systems, (10) antiseptics, disinfectants, preservatives, (11) common systemic side-effects of medications, and (12) general health.

Subject 20: Pathology and General Medical Disorders*Learning outcomes:*

The candidates should demonstrate fundamental knowledge and insight into general pathology and general medical disorder and how they can affect the eye. Knowledge and understanding should be demonstrated in the areas of: (1) inflammation and repair, (2) cardiovascular diseases and the eye, (3) blood diseases and the eye, (4) endocrine diseases and the eye, (5) neurological diseases and the eye, (6) nutritional disorders, (7) rheumatoid disorders, vasculitis and collagenosis, (8) infectious diseases, (9) tumours, and (10) congenital and hereditary conditions.

Subject 21: Epidemiology and Biostatistics*Learning outcomes:*

The candidates should demonstrate fundamental knowledge and insight into epidemiology and biostatistics, not only for application in laboratory experiments and research, but also for understanding how to interpret clinical evidence in optometric practice. Knowledge and understanding should be demonstrated in the areas of: (1) epidemiological data (incidence and prevalence, odds, relative risk, central tendency and variability), (2) screening concepts (sensitivity and specificity, predictive value, yield), (3) research design, and (4) morbidity and mortality.

Subject 22: Ocular Anatomy and Physiology*Learning outcomes:*

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and explain in detail the anatomy and physiology of the eye. Knowledge and understanding regarding structure and function, and development and ageing, should be demonstrated in the areas of: (1) orbita, (2) extraocular muscles, (3) ocular blood supply, (4) ocular and orbital nerves, (5) eyelid, (6) eyebrow, (7) conjunctiva, (8) lacrimal system, (9) cornea, (10) sclera, (11)

anterior chamber and angle, (12) iris,(13) pupil and posterior chamber, (14) ciliary body, (15) lens and zonule, (16) choroid, (17) vitreous, (18) retina, (19) optic nerve, and (20) visual pathway.

Subject 23: Ocular Pharmacology

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage patients when diagnostic drugs are indicated. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) factors affecting drug absorption, (2) cycloplegics, (3) mydriatics, (4) miotics, (5) local anaesthetics, (6) staining agents, (7) antimicrobial agents, (8) solutions used in contact lens work, (9) decongestants, antihistamines and anti-inflammatory components, (10) ocular effects of drugs used systemically, (11) first-aid and emergency measures used by optometrists, and (12) formulation of eye preparations.

Subject 24: Abnormal Ocular Conditions

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to detect and manage patients presenting with abnormal ocular conditions. Knowledge, understanding and detection skills should be demonstrated of ocular pathology affecting: (1) ocular adnexa, (2) lacrimal system, (3) conjunctiva, (4) cornea, (5) sclera and episclera, (6) anterior uvea (iris and ciliary body), (7) papillary, accommodative and refractive pathology, (8) orbit, (9) anterior chamber, angle structure and intraocular pressure (IOP), (10) lens, (11) peripheral fundus and vitreous, (12) optic nerve and the optic nerve head, (13) fovea, (14) sensory neuro-visual pathology, and (15) oculomotor neuropathology.