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The Royal Australian  
and New Zealand  
College of Ophthalmologists

# Cornea and External Eye Curriculum Standard

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## Purpose

The Cornea and External Eye Clinical Performance Standard covers the specific knowledge, processes, skills and competencies required for the diagnosis and treatment of corneal and external eye conditions.

The maintenance of a healthy ocular surface is essential for good vision and comfortable eyes. Disorders of the ocular surface are some of the most common causes of patients presenting to an ophthalmologist. A thorough knowledge of the diagnosis, examination, investigation and treatment of ocular surface disorders is an essential skill for ophthalmic trainees to acquire.

## References

### Cornea and External Eye Reading

In addition to the core texts, the following references are recommended:

- *Australian Corneal Graft Registry: Annual Report*, Flinders University, Adelaide. Accessed 20 March 2014, <<http://www.flinders.edu.au/medicine/sites/ophthalmology/clinical/the-australian-corneal-graft-registry.cfm>>

### Additional Reading

- Krachmer, J.H., Mannis, M.J. & Holland, E.J. 2011, *Cornea*, 3rd edn, Mosby/Elsevier, St Louis, MO.
- Holland, E.J., Mannis, M.J. & Lee, W.B. 2013, *Ocular surface disease: cornea, conjunctiva and tear film*, Elsevier/Saunders, London/New York, NY.

It is recommended that reading be supplemented with appropriate articles from current and relevant peer-reviewed journals.

## Level of Mastery

For each learning outcome, the level of mastery to be attained by the trainee at the end of training is indicated as follows:

***	Core knowledge of which trainees must be able to demonstrate understanding Skills and procedures that trainees must be able to perform autonomously
**	Knowledge of which trainees must have a good practical understanding Skills and procedures with which trainees should have assisted, and of which have good practical knowledge
*	Knowledge, skills and procedures of which trainees must have some understanding

## Learning outcomes and performance criteria

<b>CE1 GENERAL MEDICAL AND OCULAR HISTORY RELEVANT TO CORNEAL AND EXTERNAL EYE CONDITIONS</b>		
<p><i>This element covers the processes for observing, promoting and recording a general medical and ocular history in preparation for diagnosis and treatment of external eye and corneal conditions. The trainee is expected to have obtained and recorded a general medical and ocular history (including family history) as outlined in the Ophthalmic Basic Competencies and Knowledge (OBCK) standard.</i></p>		
<b>LEARNING OUTCOMES</b>	<b>LEVEL OF MASTERY</b>	<b>PERFORMANCE CRITERIA</b>
<b>1.1 Obtain details of current and past ocular history</b>	<b>***</b>	1.1.1 Identify risk factors that may have relevance for corneal and external eye disease
<b>1.2 Obtain an ocular family history</b>	<b>***</b>	1.2.1 Identify risk factors that may have relevance for corneal and external eye disease
<b>1.3 Identify general illnesses, drug allergies, medications, and injuries that may have an impact on ocular disease or its treatment</b>	<b>***</b>	1.3.1 Identify risk factors from general history for corneal and external eye diseases

## CE2 PERFORM EYE EXAMINATIONS FOR EXTERNAL EYE AND CORNEAL CONDITIONS

*This element covers the performance and interpretation of a range of eye examinations associated with external eye and corneal conditions. It also covers the demonstration of judgement in selecting the appropriate examinations for particular patients.*

*The trainee is expected to have performed preliminary eye examinations as outlined in the Ophthalmic Basic Competencies and Knowledge (OBCK) standard.*

LEARNING OUTCOMES	LEVEL OF MASTERY	PERFORMANCE CRITERIA
<b>2.1 Identify and describe the general appearance of the anterior eye, lids and adnexa (including lacrimal gland), through an ocular inspection</b>	***	2.1.1 From an external ocular inspection, interpret the relevance of any signs that may be found
<b>2.2 Undertake appropriate examination of the eye</b>	***	2.2.1 Perform examinations including: <ul style="list-style-type: none"> <li>• visual acuity</li> <li>• pinhole acuity</li> <li>• refraction</li> <li>• pupillary responses</li> <li>• corneal sensation</li> <li>• measurement of intra-ocular pressure</li> </ul> 2.2.2 Accurately perform, record and interpret the results of these examinations and note the relevance to the diagnosis of external eye and corneal diseases

<p><b>2.3 Perform a slit lamp examination of the anterior segment and adnexa</b></p>	<p>***</p>	<p>2.3.1 Plan the order of examinations</p> <p>2.3.2 Perform and interpret the results of anterior segment, eye and adnexal examinations, that do not require stains, as applied to external eye and corneal diseases</p> <p>2.3.3 Examine and identify pathology in the different layers of the cornea: epithelium, Bowman layer, stroma, Descemet membrane and endothelium</p> <p>2.3.4 Evert the upper eyelid</p> <p>2.3.5 Select appropriate stain and prepare patient for examinations requiring stains</p> <p>2.3.5 Perform and interpret the results of anterior segment and adnexal examinations, which require stains, as applied to external eye and corneal conditions</p> <p>2.3.6 Document the above findings with appropriate diagrams, including a cross-section of the cornea</p>
<p><b>2.4 Examine the anterior chamber</b></p>	<p>***</p>	<p>2.4.1 Perform qualitative assessment of anterior chamber including gonioscopy, assessment of inflammatory activity and state of endothelium</p>
<p><b>2.5 Undertake posterior segment examination, including examination of the optic nerve head and fundus</b></p>	<p>***</p>	<p>2.5.1 Correlate any findings with the corneal or external eye disease demonstrated</p>
<p><b>2.6 Perform a brief general medical examination relevant to ophthalmology if appropriate</b></p>	<p>***</p>	<p>2.6.1 Given a variety of general presentations (e.g. diabetes, hypertension) identify the relevance, if any, to corneal and external eye diseases</p>

<b>2.7 Perform ancillary tests to further assist in the diagnosis or documentation of external eye and corneal disease</b>	<b>***</b>	<p>2.7.1 Perform corneal scraping and culture</p> <p>2.7.2 Perform ocular biometry to assess corneal pachymetry, anterior chamber depth, lens thickness and axial length</p> <p>2.7.3 Perform lacrimal syringing and irrigation</p> <p>2.7.4 Interpret specular microscopic assessment</p> <p>2.7.5 Interpret results of conjunctival biopsy, corneal scraping, impression cytology, microbiological swabs</p> <p>2.7.6 Interpret corneal tomography and topography maps, including the principles of Placido-based and Scheimpflug imaging</p> <p>2.7.8 Perform exophthalmometry</p> <p>2.7.9 Describe the principles of anterior segment optical coherence tomography and confocal microscopy in diagnosing corneal disorders</p>
	<b>**</b>	<p>2.7.10 Perform and interpret keratometry</p> <p>2.7.11 Interpret orbital and neuro-radiological imaging</p>

<b>CE3 CHARACTERISE EXTERNAL EYE AND CORNEAL CONDITIONS</b>		
<i>This element covers the classification of types of external eye and corneal conditions and making a working and differential diagnosis.</i>		
<b>LEARNING OUTCOMES</b>	<b>LEVEL OF MASTERY</b>	<b>PERFORMANCE CRITERIA</b>
<b>3.1 Characterise anatomical abnormalities of the eyelid affecting the function of the ocular surface</b>	<b>***</b>	3.1.1 Identify and differentiate anatomical abnormalities of the eyelids
<b>3.2 Characterise the causes of inflammation and infection of the eyelid</b>	<b>***</b>	3.2.1 Identify blepharitis including meibomian gland dysfunction 3.2.2 Identify bacterial, viral, parasitic and fungal eyelid infections 3.2.3 Identify allergic, autoimmune, and dermatological conditions
<b>3.3 Characterise disorders of the tear film, tear production and drainage</b>	<b>***</b>	3.3.1 Identify features and causes of dry eye 3.3.2 Identify tear film abnormalities
<b>3.4 Characterise disorders of the lacrimal system</b>	<b>***</b>	3.4.1 Identify dacryoadenitis, dacryocystitis canaliculitis and nasolacrimal duct obstruction
<b>3.5 Characterise ocular surface tumours</b>	<b>***</b>	3.5.1 Identify dysplastic and malignant lesions of the cornea, limbus and conjunctiva
<b>3.6 Characterise infectious/microbial conjunctivitis</b>	<b>***</b>	3.6.1 Identify bacterial (including chlamydial) and viral conjunctivitis
<b>3.7 Characterise ocular allergy syndromes</b>	<b>***</b>	3.7.1 Identify seasonal and perennial conjunctivitis, vernal keratoconjunctivitis and atopic keratoconjunctivitis

<b>3.8 Characterise cicatrizing conjunctivitis</b>	<b>***</b>	<p>Identify each of the following:</p> <p>3.8.1 Ocular cicatricial pemphigoid and pseudo-cicatricial pemphigoid</p> <p>3.8.2 Erythema multiforme / Stevens-Johnson syndrome / toxic epidermal necrolysis</p> <p>3.8.3 Systemic disorders that cause conjunctival cicatrising (e.g. lymphoma)</p> <p>3.8.4 Other forms of cicatrising conjunctivitis</p>
<b>3.9 Characterise other forms of conjunctivitis</b>	<b>**</b>	<p>3.9.1 Identify each of the following:</p> <p>3.9.2 Superior limbic keratoconjunctivitis</p> <p>3.9.3 Toxic conjunctivitis</p> <p>3.9.4 Ligneous conjunctivitis</p>
<b>3.10 Identify developmental abnormalities of cornea</b>	<b>**</b>	<p>3.10.1 Identify abnormality of size, shape, structure, innervation and clarity</p> <p>3.10.2 Identify abnormal corneal sensation</p> <p>3.10.3 Identify anterior chamber cleavage syndromes</p>
<b>3.11 Characterise corneal manifestations of systemic disease</b>	<b>**</b>	<p>3.11.1 Identify each of the following:</p> <ul style="list-style-type: none"> <li>• skeletal and connective tissue disease</li> <li>• disease associated with systemic inflammation</li> <li>• haematologic disease</li> <li>• endocrine disease</li> <li>• other systemic diseases</li> </ul>
	<b>*</b>	<p>3.11.2 Identify each of the following:</p> <ul style="list-style-type: none"> <li>• metabolic disease, including: <ul style="list-style-type: none"> <li>– Fabry disease</li> <li>– mucopolysaccharidoses</li> <li>– xerophthalmia</li> </ul> </li> <li>• nutritional disorders</li> </ul>

<b>3.12 Characterise corneal and conjunctival manifestations of local and systemic therapies</b>	<b>**</b>	3.12.1 Identify manifestations of, including but not limited to: <ul style="list-style-type: none"> <li>• conjunctival and corneal deposits</li> <li>• punctuate keratopathy</li> <li>• chemical toxicity</li> <li>• drug induced dry eye syndrome</li> <li>• limbal stem cell deficiency</li> </ul>
<b>3.13 Characterise corneal and conjunctival dystrophies, degenerations and ectasia</b>	<b>***</b>	3.13.1 Identify each of the following: <ul style="list-style-type: none"> <li>• pterygium and pseudoptyerygium</li> <li>• dystrophies of epithelium and basement membrane</li> <li>• endothelial dystrophies</li> <li>• corneal and conjunctival degeneration (including concretions and conjunctival chalasis)</li> </ul>
	<b>**</b>	3.13.2 Identify each of the following: <ul style="list-style-type: none"> <li>• stromal dystrophies</li> <li>• peripheral degenerations (e.g. Terriens)</li> <li>• non-inflammatory ectatic dystrophies</li> <li>• iridocorneal endothelial syndromes</li> <li>• limbal stem cell deficiency</li> </ul>
<b>3.14 Characterise microbial keratitis</b>	<b>***</b>	3.14.1 Identify each of the following: <ul style="list-style-type: none"> <li>• bacterial keratitis</li> <li>• viral keratitis (including herpes simplex keratitis, herpes zoster ophthalmicus and adenoviral keratoconjunctivitis)</li> <li>• fungal keratitis</li> <li>• acanthamoeba and other parasitic keratitis</li> </ul>
<b>3.15 Characterise interstitial keratitis</b>	<b>**</b>	3.15.1 Identify the causes of interstitial keratitis

<b>3.16 Characterise miscellaneous keratopathies</b>	<b>***</b>	3.16.1 Identify each of the following: <ul style="list-style-type: none"> <li>• recurrent corneal erosion syndromes</li> <li>• neurotrophic keratitis</li> </ul>
	<b>**</b>	3.16.2 Identify each of the following: <ul style="list-style-type: none"> <li>• Thygesons SPK</li> <li>• nummular keratitis</li> <li>• filamentary keratitis</li> <li>• factitious keratoconjunctivitis</li> </ul>
<b>3.17 Characterise immunological disorders of the cornea and conjunctiva</b>	<b>***</b>	3.17.1 Identify each of the following: <ul style="list-style-type: none"> <li>• corneal disease in rheumatoid and non- rheumatoid collagen vascular disease</li> <li>• phlyctenular keratoconjunctivitis</li> <li>• staph antigen sensitivity</li> <li>• marginal keratitis</li> <li>• Moorens ulcer</li> </ul>
<b>3.18 Characterise chemical, thermal and mechanical injury of the cornea</b>	<b>***</b>	3.18.1 Identify each of the following injuries to the cornea: <ul style="list-style-type: none"> <li>• mechanical injury</li> <li>• acid injury</li> <li>• alkali injury</li> <li>• non-specific chemical toxicity</li> <li>• thermal injury to the cornea</li> </ul>
<b>3.19 Characterise disorders of the sclera</b>	<b>***</b>	3.19.1 Recognise and differentiate infectious from inflammatory causes of: <ul style="list-style-type: none"> <li>• episcleritis</li> <li>• scleritis</li> </ul>
<b>3.20 Characterise ocular conditions resulting from contact lens use</b>	<b>***</b>	3.20.1 Identify conjunctival and corneal effects of contact lens wear

<b>3.21 Characterise corneal, conjunctival and other external conditions resulting from previous surgery</b>	<b>***</b>	<b>3.21.1</b> Identify effects on the cornea and surrounding tissues of: <ul style="list-style-type: none"> <li>• cataract surgery</li> <li>• corneal transplantation, including penetrating keratoplasty (PKP), Descemet stripping automated endothelial keratoplasty (DSAEK / DSEK), and deep anterior lamellar keratoplasty (DALK)</li> <li>• pterygium surgery including a conjunctival autograft</li> <li>• refractive surgery</li> <li>• glaucoma filtering surgery</li> <li>• application of antimetabolites and radiation (including the effects of previous radiotherapy following pterygium surgery)</li> <li>• conjunctival surgery</li> <li>• vitreoretinal surgery</li> </ul>
	<b>**</b>	<b>3.21.2</b> Identify effects on the cornea and surrounding tissues of: <ul style="list-style-type: none"> <li>• corneal collagen cross-linking</li> </ul>
<b>3.22 Recognise evidence of previous refractive surgery</b>	<b>***</b>	<b>3.22.1</b> Identify each of the following: <ul style="list-style-type: none"> <li>• previous laser photo refractive keratectomy (PRK)</li> <li>• previous laser-assisted in situ keratomileusis (LASIK)</li> <li>• previous incisional refractive surgery, including arcuate/astigmatic keratotomy (AK) and radial keratotomy (RK)</li> <li>• corneal stromal implants</li> </ul>

<b>CE4 DEVELOP AND IMPLEMENT A MANAGEMENT PLAN FOR EXTERNAL EYE AND CORNEAL CONDITIONS</b>		
<p><i>This element covers the management of external eye and corneal conditions using observation, medical therapies and surgery including postoperative care.</i></p> <p><i>The trainee must adhere to the standards of practice, in particular those regarding informed consent and clinical record-keeping, described in the Ophthalmic Basic Competencies and Knowledge (OBCK) standard.</i></p>		
<b>LEARNING OUTCOMES</b>	<b>LEVEL OF MASTERY</b>	<b>PERFORMANCE CRITERIA</b>
<b>4.1 Determine and document in medical records a management plan for each patient</b>	<b>***</b>	<p>4.1.1 Integrate information from the history and examination to determine likely prognosis</p> <p>4.1.2 Choose appropriate management strategies</p> <p>4.1.3 Establish initial management targets</p>
<b>4.2 Educate the patient</b>	<b>***</b>	<p>4.2.1 Explain the nature of the patients' corneal and/or external eye condition</p> <p>4.2.2 Explain clearly the proposed management regimen and the potential consequences thereof, including genetic counselling</p> <p>4.2.3 Obtain and record the patient's informed consent to the management regimen where appropriate</p>
<b>4.3 Understand the role of observation as part of management plan</b>	<b>***</b>	<p>4.3.1 Establish and record appropriate baseline parameters</p> <p>4.3.2 Maintain documentation including imaging that charts the progress of the observations</p>
<b>4.4 Manage corneal and external eye disease with medical treatment</b>	<b>***</b>	<p>4.4.1 Undertake first aid and emergency management procedures for ocular trauma</p> <p>4.4.2 Monitor the efficacy of the medical therapy, identify complications of the therapy and make necessary adjustments to the management regimen</p>

		4.4.3 Be familiar with the use of rigid gas permeable contact lenses and scleral contact lenses in the treatment of irregular astigmatism and ectatic disease
<b>4.5 Perform surgery to manage external eye and corneal conditions</b>	<b>***</b>	<p>4.5.1 Counsel patient on the surgical procedure, and obtain consent</p> <p>4.5.2 Perform tarsorrhaphy</p> <p>4.5.3 Perform electrolysis for the treatment of trichiasis</p> <p>4.5.4 Perform techniques for repair of entropion and ectropion</p> <p>4.5.5 Perform excision of pterygium and pinguecula including conjunctival autograft</p> <p>4.5.6 Suture corneal lacerations</p> <p>4.5.7 Glue corneal perforation and apply corneal bandage lens</p> <p>4.5.8 Use epithelial debridement or bandage contact lens to aid in epithelial healing</p>
	<b>**</b>	<p>4.5.9 Recognise and provide appropriate medical and surgical management of corneal and conjunctival tumours and neoplastic disease</p> <p>4.5.10 Inject botulinum toxin to induce ptosis</p> <p>4.5.11 Describe the indications and techniques of lamellar (including DSAEK, DSEK, and DALK) and penetrating keratoplasty</p> <p>4.5.12 Be familiar with the technique of corneal collagen cross-linking for progressive keratoconus</p> <p>4.5.13 Be familiar with the procurement, processing, storage and selection of donor corneal material</p>

	*	<p>4.5.14 Be familiar with techniques of limbal stem cell transplantation</p> <p>4.5.15 Perform stromal micropuncture</p> <p>4.5.16 Perform cryotherapy for the treatment of trichiasis</p> <p>4.5.17 Be familiar with the use of intracorneal stromal rings to treat keratoconus</p> <p>4.5.18 Perform partial conjunctival flaps</p> <p>4.5.19 Be familiar with Gunderson conjunctival flaps</p> <p>4.5.20 Be familiar with the use of excimer laser phototherapeutic keratectomy (PTK) for disorders of the epithelium and anterior stroma</p>
<b>4.6 Undertake postoperative management</b>	***	<p>4.6.1 Identify and manage postoperative complications</p> <p>4.6.2 Identify and manage corneal graft rejection, vascularization and suture related complications</p>
<b>4.7 Demonstrate appropriate decision making with regard to referral of patients</b>	***	<p>4.7.1 Refer patient in a timely manner, with a comprehensive case history (oral or written) to the appropriate specialist</p> <p>4.7.2 Share management with an appropriate specialist (e.g. patients requiring immunosuppression, those with infectious disease or allergies, and paediatric patients)</p>

## Context

In order to fulfil the clinical performance standards, the trainee must apply the knowledge and skills described in the:

- Ophthalmic Sciences (Anatomy, Clinical Ophthalmic and Emergency Medicine, Optics, Physiology, Clinical Genetics and Microbiology, and Evidence-based Ophthalmic Practice);
- Ophthalmic Basic Competencies and Knowledge (OBCK); and,
- Basics of Ophthalmic Surgery (BOS) curriculum standards.

## ***Clinical practice***

The following list is provided to identify the conditions, their causes and sequelae, and the treatment approaches that may be encountered by the trainee in clinical practice. The list is not exhaustive; it is intended as a guide for the use of the trainee when planning his or her learning.

### **Cornea and External Eye Topic List**

- Systemic disease with ocular manifestations, or diseases that impact on the diagnosis or external eye or corneal conditions including but not limited to:
  - endocrine and metabolic diseases such as diabetes
  - allergy
  - auto immune diseases
  - neurological disease
  - collagen vascular disorders
  - mucocutaneous disorders
  - oncology and chemotherapy
  - chemical and physical insults
  - infectious diseases including, but not limited to, sexually transmitted diseases
  - nutritional disease and conditions
- Medications with ocular and systemic effects impacting on external eye and corneal diseases including but not limited to:
  - topical medications, their vehicles and preservatives
  - systemic medications including but not limited to:
    - psychotropics
    - rheumatological medications
    - antiarrhythmics
    - chemotherapeutic agents
    - alpha blocking agents
- Environmental conditions that impact on external eye and corneal diseases including but not limited to ultraviolet light, housing and hygiene conditions.
- Ocular medications and their local and systemic side effects
- Eye injuries, including their long term effects
- Ophthalmic procedures, including their long term effects
- Principles of brief general examination

- Signs of systemic disease
- Performance and interpretation of findings of external ocular examination including, but not limited to, the assessment of:
  - Bell phenomenon
  - lagophthalmos
  - corneal sensation
  - tear film break-up time
  - corneal stains (e.g. fluorescein, Rose Bengal and lissamine green)
  - Schirmer test
- Use of slit lamp and interpretation of findings on examination of:
  - eyelids
  - conjunctiva (bulbar, tarsal and forniceal) including cicatrisation
  - cornea: epithelium, Bowman layer, stroma, Descemet membrane, endothelium
  - anterior chamber: depth, presence of cells/flare
  - iris
  - lens
  - angle structure and grading
- Knowledge of the diagnosis and management of each of the conditions relevant to the areas listed in element CE3