



La-Net

OPT 603

**CORNEA, EXTERNAL
EYE DISEASES,
LACRIMAL SYSTEM,
ORBIT**



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Course code: OPT 603

Course title: Cornea, External Eye Diseases, Lacrimal System, Orbit

Course credit load: 1 Unit

Series 1: Anatomy of the Lids, Conjunctiva, Cornea, Lacrimal System, and Orbit

- **Part 1.1: Anatomy of the Eyelids**
 - Sub Part 1.1.1: Eyelid structure and layers
 - Sub Part 1.1.2: Eyelid margin and glands
 - Sub Part 1.1.3: Eyelid muscles and their innervation
- **Part 1.2: Anatomy of the Conjunctiva and Cornea**
 - Sub Part 1.2.1: Anatomy of the conjunctiva
 - Sub Part 1.2.2: Layers of the cornea
 - Sub Part 1.2.3: Corneal innervation and limbal anatomy
- **Part 1.3: Anatomy of the Lacrimal System and Orbit**
 - Sub Part 1.3.1: The lacrimal gland and secretory system
 - Sub Part 1.3.2: The lacrimal drainage system
 - Sub Part 1.3.3: Relevant orbital anatomy

Introduction

Confident assessment of the external eye begins with a clear understanding of the **anatomy** of the eyelids, conjunctiva, cornea, lacrimal system, and orbit, the structures forming the primary focus of this course. This opening Series establishes this essential structural foundation, forming the basis for every subsequent clinical topic examined throughout this course.

The aim of this Series is to equip you with a thorough understanding of the basic anatomy of the lids, conjunctiva, cornea, lacrimal system, and orbit.

This Series begins with the **anatomy of the eyelids**, before examining the **anatomy of the conjunctiva and cornea**. It concludes with the **anatomy of the lacrimal system and orbit**.



Series Learning Outcomes

At the end of this Series, you should be able to:

- **SLO 1.1:** describe the structure, layers, margin, and glands of the eyelid
- **SLO 1.2:** describe the eyelid muscles and their innervation
- **SLO 1.3:** describe the anatomy of the conjunctiva and the layers of the cornea
- **SLO 1.4:** describe corneal innervation and limbal anatomy
- **SLO 1.5:** describe the lacrimal gland, secretory system, and lacrimal drainage system, and
- **SLO 1.6:** describe relevant orbital anatomy.

1.1 Anatomy of the Eyelids

1.1.1 eyelid structure and layers

A multilayered structure protecting the anterior globe

The **eyelid** comprises several distinct layers, from the outer **skin**, among the thinnest of the entire body, through the underlying **orbicularis oculi muscle**, discussed further later in this Part, the **tarsal plate**, providing structural rigidity, and the innermost **palpebral conjunctiva**, discussed further later in this Series.

This layered structure allows the eyelid to perform its essential protective function, discussed in relation to blinking and tear film distribution in an earlier related course, while remaining sufficiently thin and mobile to permit rapid, repeated blinking without undue **fatigue**.

Fill in the blank: The eyelid comprises several distinct layers, from the outer skin through the orbicularis oculi muscle, the tarsal plate, and the innermost palpebral _____.

1.1.2 eyelid margin and glands

The **eyelid margin** houses the eyelash follicles, associated **glands of Zeis** and **glands of Moll**, and the **meibomian glands**, discussed in relation to tear film composition in an earlier related course, embedded within the tarsal plate and opening along the posterior lid margin, contributing the oily layer of the tear film.



The **grey line**, discussed in relation to eyelid margin anatomy, marks the division between the anterior and posterior lamellae of the eyelid, an important surgical landmark given its relevance to accurate lid margin **repair**, discussed further in a later Series of this course.

Fill in the blank: The eyelid margin houses the eyelash follicles, glands of Zeis and Moll, and the meibomian glands, contributing the oily layer of the tear _____.

1.1.3 eyelid muscles and their innervation

The **orbicularis oculi** muscle, discussed earlier in this Part, encircling the eyelid, produces eyelid closure, and is innervated by the **facial nerve**, while the **levator palpebrae superioris**, the principal eyelid elevator, is innervated by the **oculomotor nerve**.

Müller's muscle, a smaller, sympathetically innervated accessory eyelid elevator, discussed in relation to lid position later in this course, provides additional, involuntary lid elevation, meaning disruption of either its sympathetic innervation or the oculomotor nerve can each independently produce clinically significant eyelid **malposition**.

Fill in the blank: Müller's muscle, a smaller, sympathetically innervated accessory eyelid elevator, provides additional, involuntary lid _____.

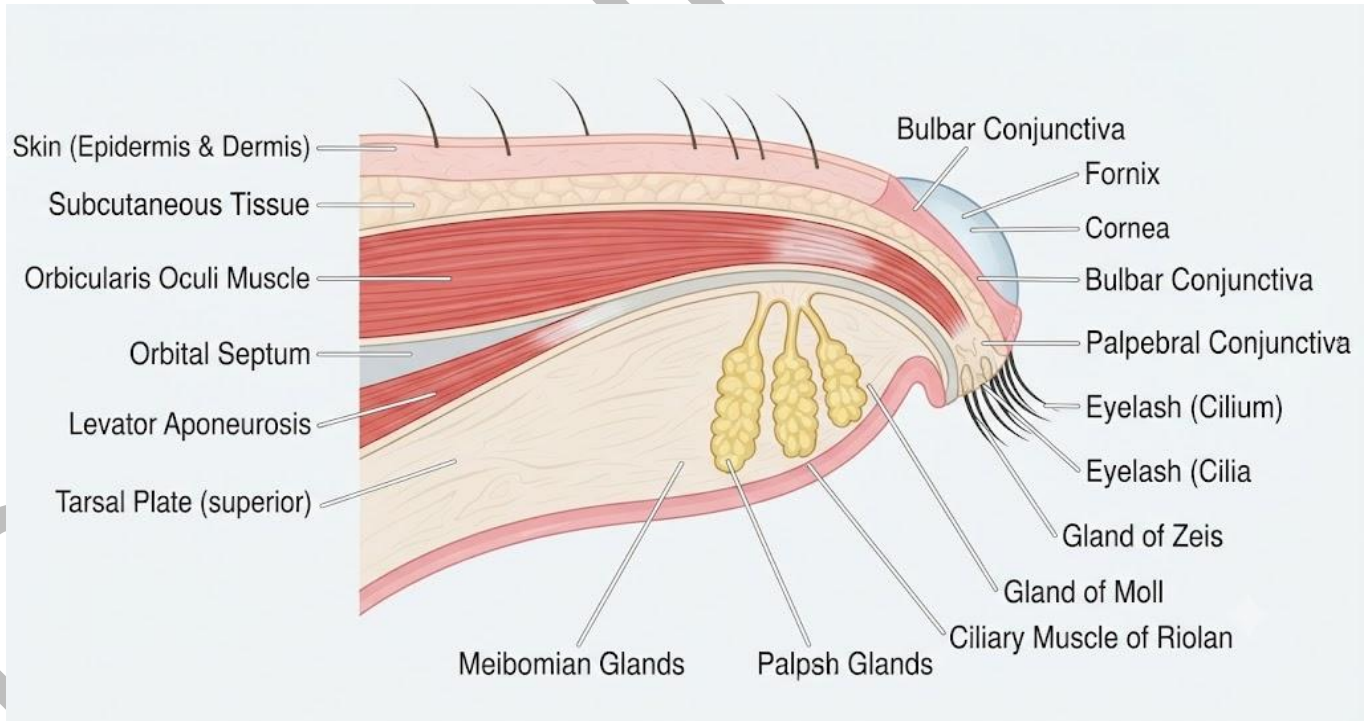


Figure 1.1: Diagram of the eyelid in cross-section showing skin, orbicularis oculi, tarsal plate, and palpebral conjunctiva.



Pilot questions 1.1

1. List the layers of the eyelid from outer to inner. (Linked to SLO 1.1)
2. Describe the structures housed within the eyelid margin. (Linked to SLO 1.1)
3. Define the grey line and its clinical relevance. (Linked to SLO 1.1)
4. Name the muscle producing eyelid closure and its innervating nerve. (Linked to SLO 1.2)
5. Name the principal eyelid elevator and its innervating nerve, and describe Müller's muscle. (Linked to SLO 1.2)

1.2 Anatomy of the Conjunctiva and Cornea

1.2.1 anatomy of the conjunctiva

A thin mucous membrane lining the eye and eyelids

The **conjunctiva** is divided into the **palpebral conjunctiva**, discussed earlier in this Series, lining the inner eyelid surface, the **bulbar conjunctiva**, covering the anterior sclera, and the **fornix**, the reflection point joining these two portions, allowing free ocular movement beneath the eyelids.

The conjunctiva contains **goblet cells**, contributing the mucin layer of the tear film, discussed in relation to tear film composition in a later Series of this course, and a rich vascular supply, discussed in relation to conjunctival injection in a later Series of this course, contributing to its characteristic appearance during **inflammation**.

Fill in the blank: The conjunctiva is divided into the palpebral conjunctiva, the bulbar conjunctiva, and the fornix, the reflection point joining these two _____.

1.2.2 layers of the cornea

The **cornea**, discussed in relation to refractive anatomy in an earlier related course, comprises five distinct histological layers, the outer **epithelium**, **Bowman's layer**, the **stroma**, comprising the majority of corneal thickness, **Descemet's membrane**, and the innermost **endothelium**.



The corneal **endothelium**, discussed earlier in this Part, maintains corneal **deturgescence**, the relative dehydration essential to corneal transparency, through active pumping of fluid out of the stroma, meaning endothelial dysfunction can produce corneal oedema and reduced **clarity**.

Fill in the blank: The corneal endothelium maintains corneal deturgescence, the relative dehydration essential to corneal transparency, through active pumping of fluid out of the _____.

1.2.3 corneal innervation and limbal anatomy

The cornea receives dense sensory innervation from the **ophthalmic division** of the trigeminal nerve, discussed in relation to corneal sensitivity, explaining the cornea's characteristic marked sensitivity to touch and its important protective **blink reflex**.

The **limbus**, discussed in relation to danger sign recognition in an earlier related course, marks the transition zone between the cornea and sclera, containing **limbal stem cells** essential for ongoing corneal epithelial regeneration, meaning significant limbal injury or disease can compromise long-term corneal surface **integrity**.

Fill in the blank: The limbus contains limbal stem cells essential for ongoing corneal epithelial regeneration, meaning significant limbal injury or disease can compromise long-term corneal surface _____.

Table 1.2: The five layers of the cornea.

Layer	Position	Key feature
Epithelium	Outermost	Regenerating surface layer with dense sensory innervation
Stroma	Middle, comprising most corneal thickness	Organised collagen contributing to transparency
Endothelium	Innermost	Maintains corneal deturgescence through active fluid pumping

Pilot questions 1.2

1. Describe the three portions of the conjunctiva. (Linked to SLO 1.3)
2. Describe the function of conjunctival goblet cells. (Linked to SLO 1.3)
3. List the five layers of the cornea. (Linked to SLO 1.3)
4. Describe the function of the corneal endothelium. (Linked to SLO 1.4)
5. Describe corneal innervation and the significance of the limbus. (Linked to SLO 1.4)



1.3 Anatomy of the Lacrimal System and Orbit

1.3.1 the lacrimal gland and secretory system

Two glandular components producing the aqueous tear layer

The **lacrimal gland**, discussed in relation to tear production in a later Series of this course, is located in the superolateral orbit, divided into a larger **orbital lobe** and a smaller **palpebral lobe**, producing the majority of reflex tear secretion in response to irritation or emotional stimulus.

Accessory lacrimal glands, discussed in relation to basal tear production, located within the conjunctiva itself, discussed earlier in this Series, provide the continuous baseline tear secretion required for ongoing ocular surface **lubrication** between episodes of reflex tearing.

Fill in the blank: The lacrimal gland is divided into a larger orbital lobe and a smaller palpebral lobe, producing the majority of reflex tear _____ in response to irritation or emotional stimulus.

1.3.2 the lacrimal drainage system

The **lacrimal drainage system**, discussed in relation to tear drainage in an earlier related course, begins at the **puncta**, small openings at the medial aspect of each eyelid margin, leading into the **canaliculi**, which converge to form the **common canaliculus** before entering the lacrimal sac.

From the **lacrimal sac**, tears drain via the **nasolacrimal duct** into the inferior nasal meatus, discussed in relation to lacrimal apparatus anatomy in an earlier related course, with obstruction at any point along this pathway producing recognisable patterns of epiphora, or excessive tearing, discussed further in a later Series of this course.

Fill in the blank: From the lacrimal sac, tears drain via the nasolacrimal duct into the inferior nasal _____.

1.3.3 relevant orbital anatomy

Orbital anatomy relevant to this course, discussed in relation to the bony orbit in an earlier related course, includes the **orbital septum**, a fibrous membrane separating the eyelid from deeper orbital fat and structures, an important surgical and clinical landmark relevant to distinguishing superficial from deeper orbital infection.

Further relevant orbital anatomy includes the **extraocular muscles**, discussed in relation to ocular motility in an earlier related course, and the orbital fat compartments, with disease processes affecting these deeper orbital structures, discussed further in a later Series of this



course, distinguished clinically from more superficial eyelid disease by their relationship to the orbital **septum**.

Fill in the blank: The orbital septum is an important surgical and clinical landmark relevant to distinguishing superficial from deeper orbital _____.

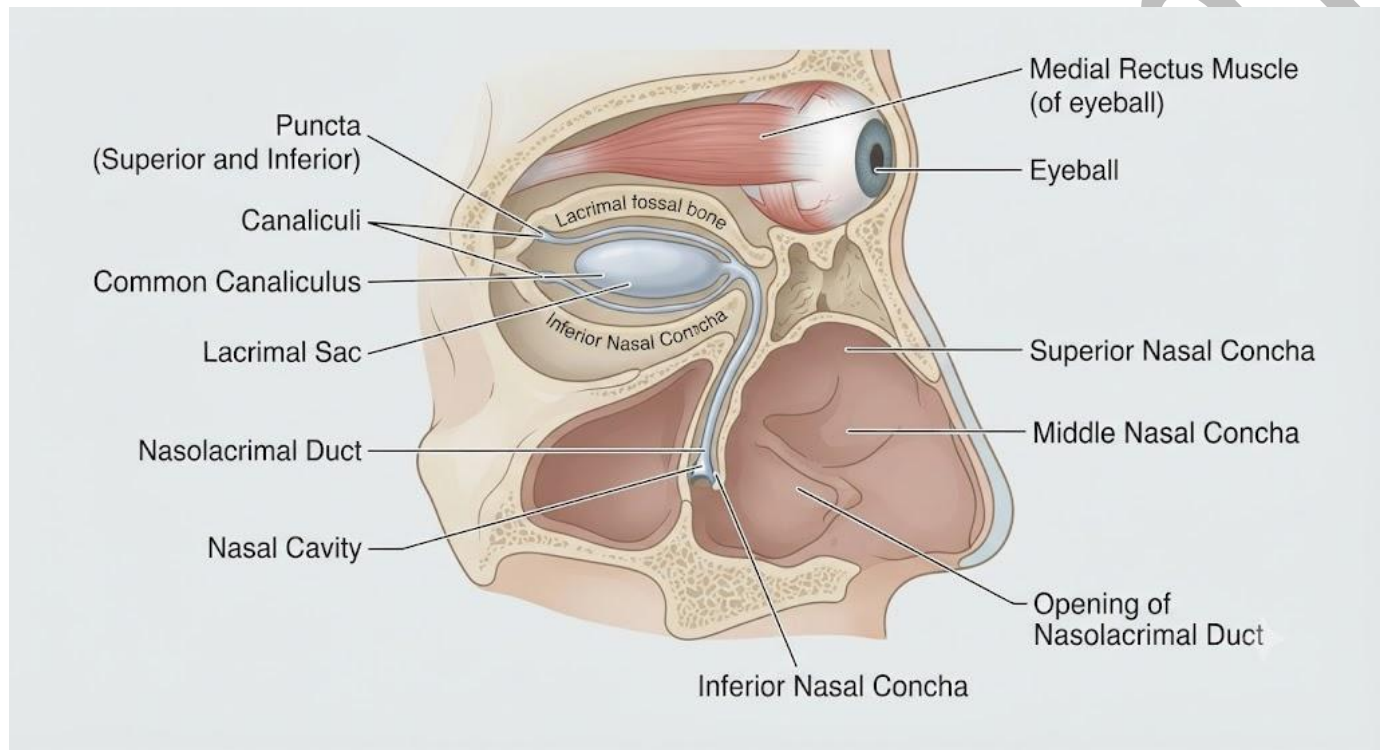


Figure 1.3: Diagram illustrating the lacrimal drainage pathway from the puncta through the canaliculi, lacrimal sac, and nasolacrimal duct to the inferior nasal meatus.

Pilot questions 1.3

1. Describe the location and lobes of the lacrimal gland. (Linked to SLO 1.5)
2. Distinguish reflex tear secretion from basal tear secretion. (Linked to SLO 1.5)
3. Trace the pathway of the lacrimal drainage system from puncta to nasal cavity. (Linked to SLO 1.5)
4. Describe the orbital septum and its clinical relevance. (Linked to SLO 1.6)
5. List further relevant orbital anatomy beyond the septum. (Linked to SLO 1.6)

Series Summary

This opening Series established the anatomical foundation of external eye and orbital disease, beginning with the **anatomy of the eyelids**, structure, margin, glands, and innervation, before



examining the **anatomy of the conjunctiva and cornea**, the three conjunctival portions and the five corneal layers.

We concluded with the **anatomy of the lacrimal system and orbit**, the lacrimal gland, drainage system, and relevant orbital anatomy. Having worked through this Series, you should now possess the essential structural foundation needed to understand tear physiology and the red eye examined in the next Series of this course.

Glossary of Terms

- **Tarsal plate:** the rigid connective tissue structure providing structural support to the eyelid.
- **Meibomian glands:** glands within the tarsal plate producing the oily layer of the tear film.
- **Grey line:** the surgical landmark dividing the anterior and posterior lamellae of the eyelid.
- **Orbicularis oculi:** the muscle producing eyelid closure, innervated by the facial nerve.
- **Levator palpebrae superioris:** the principal eyelid elevator muscle, innervated by the oculomotor nerve.
- **Müller's muscle:** a sympathetically innervated accessory eyelid elevator.
- **Fornix:** the conjunctival reflection point joining the palpebral and bulbar portions.
- **Corneal deturgescence:** the relative dehydration of the cornea essential to its transparency.
- **Limbal stem cells:** cells at the corneal limbus essential for ongoing corneal epithelial regeneration.
- **Puncta:** the small openings at the medial eyelid margin marking the start of the lacrimal drainage system.
- **Nasolacrimal duct:** the terminal portion of the lacrimal drainage system draining into the inferior nasal meatus.
- **Orbital septum:** a fibrous membrane separating the eyelid from deeper orbital structures.

Concept Check Questions [Series 1]

Objective questions



1. The eyelid comprises several distinct layers, from the outer skin through the orbicularis oculi muscle, the tarsal plate, and the innermost palpebral _____.
2. Müller's muscle, a smaller, sympathetically innervated accessory eyelid elevator, provides additional, involuntary lid _____.
3. The corneal endothelium maintains corneal deturgescence through active pumping of fluid out of the _____.
4. The lacrimal gland is divided into a larger orbital lobe and a smaller palpebral lobe, producing the majority of reflex tear _____.
5. The orbital septum is an important surgical and clinical landmark relevant to distinguishing superficial from deeper orbital _____.

Short-answer questions

6. List the layers of the eyelid from outer to inner.
7. Name the muscle producing eyelid closure and its innervating nerve.
8. List the five layers of the cornea.
9. Distinguish reflex tear secretion from basal tear secretion.
10. Trace the pathway of the lacrimal drainage system from puncta to nasal cavity.

Long-answer questions

11. Discuss the structure, layers, margin, glands, muscles, and innervation of the eyelid. (Linked to SLO 1.1, SLO 1.2)
12. Discuss the anatomy of the conjunctiva and the layers of the cornea. (Linked to SLO 1.3)
13. Discuss corneal innervation and limbal anatomy. (Linked to SLO 1.4)
14. Discuss the lacrimal gland, secretory system, and lacrimal drainage system. (Linked to SLO 1.5)
15. Discuss relevant orbital anatomy. (Linked to SLO 1.6)

Answers to Concept Check Questions [Series 1]

Objective questions

1. Conjunctiva.
2. Elevation.
3. Stroma.
4. Secretion.
5. Infection.

Short-answer questions



6. Skin, orbicularis oculi muscle, tarsal plate, and palpebral conjunctiva.
7. Orbicularis oculi, innervated by the facial nerve.
8. Epithelium, Bowman's layer, stroma, Descemet's membrane, and endothelium.
9. Reflex secretion, produced by the main lacrimal gland in response to irritation or emotion; basal secretion, produced continuously by accessory lacrimal glands.
10. Puncta, canaliculi, common canaliculus, lacrimal sac, nasolacrimal duct, and finally the inferior nasal meatus.

Long-answer questions

11. **Basic response:** The eyelid comprises layered skin, orbicularis oculi, tarsal plate, and palpebral conjunctiva, with the margin housing glands and lashes.

Value-added response: Eyelid closure is produced by the facially innervated orbicularis oculi, while elevation depends on the oculomotor-innervated levator and sympathetically innervated Müller's muscle.

12. **Basic response:** The conjunctiva comprises palpebral, bulbar, and fornix portions, containing goblet cells contributing the tear film's mucin layer.

Value-added response: The cornea comprises five layers, epithelium, Bowman's layer, stroma, Descemet's membrane, and endothelium, each contributing to overall corneal function.

13. **Basic response:** The cornea receives dense sensory innervation from the ophthalmic division of the trigeminal nerve, explaining its marked sensitivity.

Value-added response: The limbus contains stem cells essential for ongoing corneal epithelial regeneration, meaning limbal injury can compromise long-term corneal surface integrity.

14. **Basic response:** The lacrimal gland's orbital and palpebral lobes produce reflex tearing, while accessory glands provide continuous basal secretion.

Value-added response: The drainage system carries tears from the puncta through the canaliculi and lacrimal sac to the nasolacrimal duct and nasal cavity.

15. **Basic response:** The orbital septum separates the eyelid from deeper orbital structures, an important landmark distinguishing superficial from deep infection.

Value-added response: Further orbital anatomy, including the extraocular muscles and orbital fat, is relevant to understanding orbital disease processes discussed later in this course.



Part 1.1

1. Skin, orbicularis oculi muscle, tarsal plate, and palpebral conjunctiva.
2. Eyelash follicles, glands of Zeis and Moll, and meibomian glands.
3. It marks the division between the anterior and posterior lamellae of the eyelid, an important surgical landmark for lid margin repair.
4. Orbicularis oculi, innervated by the facial nerve.
5. Levator palpebrae superioris, innervated by the oculomotor nerve; Müller's muscle is a smaller, sympathetically innervated accessory elevator.

Part 1.2

1. Palpebral conjunctiva, lining the inner eyelid; bulbar conjunctiva, covering the sclera; and the fornix, the reflection point joining them.
2. They contribute the mucin layer of the tear film.
3. Epithelium, Bowman's layer, stroma, Descemet's membrane, and endothelium.
4. It maintains corneal deturgescence, the relative dehydration essential to transparency, through active fluid pumping.
5. Dense sensory innervation from the ophthalmic division of the trigeminal nerve; the limbus contains stem cells essential for epithelial regeneration.

Part 1.3

1. Located in the superolateral orbit, divided into a larger orbital lobe and smaller palpebral lobe.
2. Reflex secretion is produced by the main lacrimal gland in response to irritation or emotion; basal secretion is continuous, from accessory glands.
3. Puncta, canaliculi, common canaliculus, lacrimal sac, nasolacrimal duct, and finally the inferior nasal meatus.
4. A fibrous membrane separating the eyelid from deeper orbital structures, an important landmark distinguishing superficial from deep infection.
5. The extraocular muscles and orbital fat compartments.



References and Attributions [Series 1]

- Kanski, J. J., & Bowling, B. (2015). *Clinical Ophthalmology: A Systematic Approach* (8th ed.). Elsevier.
- Snell, R. S., & Lemp, M. A. (2013). *Clinical Anatomy of the Eye* (2nd ed.). Wiley-Blackwell.
- Collin, J. R. O. (2006). *A Manual of Systematic Eyelid Surgery* (3rd ed.). Elsevier.
- Cassin, B., & Solomon, S. (2001). *Dictionary of Eye Terminology* (4th ed.). Triad Publishing.

Figures, Plates, Tables, and Boxes

- Figure 1.1: Diagram of the eyelid in cross-section showing skin, orbicularis oculi, tarsal plate, and palpebral conjunctiva. AI-generated using the prompt: "A single clean, accurate anatomical cross-sectional diagram of the eyelid with labelled layers from outer skin through orbicularis oculi, tarsal plate with meibomian glands, to inner palpebral conjunctiva, textbook anatomical diagram style, neutral background, no photographic realism, no other panels."
- Table 1.2: The five layers of the cornea. AI-generated using the prompt: "Create a clean anatomical reference table titled The Five Layers of the Cornea, listing layer, position, and key feature. Ophthalmology reference table style with outside border, no photographic elements."
- Figure 1.3: Diagram illustrating the lacrimal drainage pathway from the puncta through the canaliculi, lacrimal sac, and nasolacrimal duct to the inferior nasal meatus. AI-generated using the prompt: "A single clean, accurate anatomical diagram of the medial eye and nose region showing labelled puncta, canaliculi, lacrimal sac, and nasolacrimal duct leading to the nasal cavity, textbook anatomical diagram style, neutral background, no photographic realism, no other panels."



Course code: OPT 603

Course title: Cornea, External Eye Diseases, Lacrimal System, Orbit

Course credit load: 1 Unit

Series 2: Tear Physiology and the Red Eye

- **Part 2.1: Tear Film Production and Drainage**
 - Sub Part 2.1.1: Composition of the tear film
 - Sub Part 2.1.2: Tear production
 - Sub Part 2.1.3: Tear drainage and the blink cycle
- **Part 2.2: Causes and Symptoms of Red Eye**
 - Sub Part 2.2.1: Common causes of red eye
 - Sub Part 2.2.2: Symptoms associated with red eye
 - Sub Part 2.2.3: Relating symptoms to likely underlying cause
- **Part 2.3: Differentiating and Interpreting the Red Eye**
 - Sub Part 2.3.1: Steps to differentiate red eye
 - Sub Part 2.3.2: Differentiating ciliary from conjunctival injection
 - Sub Part 2.3.3: Interpreting findings in the red eye

Introduction

In the last Series, we established the anatomy of the lids, conjunctiva, cornea, lacrimal system, and orbit. We now turn to **tear physiology**, the composition, production, and drainage of the tear film, and the essential clinical skill of assessing the **red eye**, its common causes, associated symptoms, and the systematic steps required to differentiate and interpret findings, including the critical distinction between conjunctival and ciliary injection.

The aim of this Series is to equip you with a thorough understanding of tear production and drainage, common causes of red eye, symptoms associated with red eye, steps to differentiate red eye and interpret findings, and differentiating ciliary and conjunctival injection.



This Series begins with **tear film production and drainage**, before examining **causes and symptoms of red eye**. It concludes with **differentiating and interpreting the red eye**.

Series Learning Outcomes

At the end of this Series, you should be able to:

- **SLO 2.1:** describe the composition and production of the tear film
- **SLO 2.2:** describe tear drainage and its relationship to the blink cycle
- **SLO 2.3:** describe common causes of red eye
- **SLO 2.4:** describe symptoms associated with red eye
- **SLO 2.5:** describe the steps used to differentiate the causes of red eye, and
- **SLO 2.6:** differentiate ciliary from conjunctival injection and interpret findings in the red eye.

2.1 Tear Film Production and Drainage

2.1.1 composition of the tear film

A three-layered structure protecting and nourishing the ocular surface

The **tear film** comprises three distinct layers, the outer **lipid layer**, produced by the meibomian glands, discussed in relation to eyelid margin anatomy in the previous Series of this course, reducing evaporation, and the middle **aqueous layer**, comprising the bulk of tear film volume.

The innermost **mucin layer**, produced by conjunctival **goblet cells**, discussed earlier in this course, allows the otherwise hydrophobic corneal epithelial surface to be evenly wetted by the overlying aqueous layer, meaning disruption of any single tear film component can produce ocular surface **dryness** despite otherwise adequate overall tear volume.

Fill in the blank: The innermost mucin layer, produced by conjunctival goblet cells, allows the otherwise hydrophobic corneal epithelial surface to be evenly wetted by the overlying aqueous _____.

2.1.2 tear production



Basal tear secretion, discussed in relation to accessory lacrimal glands in the previous Series of this course, provides continuous baseline ocular surface lubrication, while **reflex tear secretion**, produced by the main lacrimal gland, discussed earlier in this course, responds to irritation, foreign body sensation, or emotional stimulus with substantially increased tear **volume**.

Tear production is additionally influenced by **autonomic innervation**, with parasympathetic stimulation promoting lacrimal gland secretion, meaning conditions affecting this autonomic pathway, discussed in relation to nerve function throughout this course, can produce clinically significant reduced tear **production**.

Fill in the blank: Tear production is additionally influenced by autonomic innervation, with parasympathetic stimulation promoting lacrimal gland _____.

2.1.3 tear drainage and the blink cycle

Tear drainage, discussed in relation to the lacrimal drainage pathway in the previous Series of this course, is actively assisted by the **blink cycle**, with contraction of the orbicularis oculi muscle, discussed earlier in this course, generating a pumping action that draws tears into the canaliculi and toward the **lacrimal sac**.

This coordinated relationship between blinking and tear drainage means conditions impairing normal eyelid closure or blink function, discussed further in a later Series of this course, can produce both inadequate tear film distribution across the ocular surface and impaired tear **drainage**, together contributing to ocular surface disease.

Fill in the blank: Contraction of the orbicularis oculi muscle generates a pumping action that draws tears into the canaliculi and toward the lacrimal _____.

Table 2.1: The three layers of the tear film.

Layer	Source	Primary function
Lipid layer	Meibomian glands	Reduces evaporation of the tear film
Aqueous layer	Main and accessory lacrimal glands	Provides the bulk of tear film volume
Mucin layer	Conjunctival goblet cells	Allows even wetting of the corneal surface

Pilot questions 2.1

- List the three layers of the tear film and their source. (Linked to SLO 2.1)



- Describe the function of the mucin layer. (Linked to SLO 2.1)
- Distinguish basal from reflex tear secretion. (Linked to SLO 2.1)
- Describe the role of autonomic innervation in tear production. (Linked to SLO 2.1)
- Describe how the blink cycle assists tear drainage. (Linked to SLO 2.2)

2.2 Causes and Symptoms of Red Eye

2.2.1 common causes of red eye

A spectrum from benign external causes to sight-threatening disease

Common causes of **red eye** include **conjunctivitis**, discussed in relation to conjunctival anatomy in an earlier Series of this course, whether infective, allergic, or irritant, **subconjunctival haemorrhage**, and **dry eye disease**, discussed in relation to tear film composition earlier in this Series.

Further recognised causes include **blepharitis**, discussed further in a later Series of this course, corneal conditions such as keratitis or foreign body, and, less commonly but of genuine clinical importance, intraocular causes such as uveitis or acute glaucoma, each requiring careful clinical **differentiation**.

Fill in the blank: Common causes of red eye include conjunctivitis, subconjunctival haemorrhage, and dry eye disease, each requiring careful clinical _____.

2.2.2 symptoms associated with red eye

Symptoms associated with red eye include **itching**, generally suggestive of an allergic cause, **discharge**, discussed in relation to conjunctivitis earlier in this Part, whether watery, mucoid, or purulent, and **foreign body sensation**, discussed in relation to corneal innervation in the previous Series of this course.

Further important symptoms include **pain**, generally suggestive of corneal or intraocular involvement rather than simple conjunctival disease, **photophobia**, and reduced **visual acuity**, discussed in relation to visual acuity testing in an earlier related course, each carrying specific relevance to the likely underlying diagnostic **category**.

Fill in the blank: Further important symptoms associated with red eye include pain, generally suggestive of corneal or intraocular involvement rather than simple conjunctival disease, photophobia, and reduced visual _____.



2.2.3 relating symptoms to likely underlying cause

Careful correlation of the specific symptom **pattern**, discussed earlier in this Part, with examination findings, discussed further later in this Series, generally allows reasonably confident distinction between the relatively benign, superficial causes of red eye and the less common but genuinely serious, sight-threatening **causes**.

For example, itching and watery discharge generally suggest allergic conjunctivitis, while significant pain, photophobia, and reduced visual acuity suggest a more serious underlying process, discussed further later in this Series, meaning symptom pattern recognition represents a genuinely valuable initial diagnostic **tool**.

Fill in the blank: Itching and watery discharge generally suggest allergic conjunctivitis, while significant pain, photophobia, and reduced visual acuity suggest a more serious underlying _____.

Table 2.2: Relating red eye symptoms to likely underlying cause.

Symptom pattern	Suggested cause	Level of concern
Itching, watery discharge	Allergic conjunctivitis	Generally low concern
Purulent discharge, minimal pain	Bacterial conjunctivitis	Generally low to moderate concern
Significant pain, photophobia, reduced acuity	Corneal or intraocular disease	High concern, urgent assessment warranted

Pilot questions 2.2

1. List common causes of red eye. (Linked to SLO 2.3)
2. List symptoms associated with red eye. (Linked to SLO 2.4)
3. Explain the diagnostic significance of pain as a red eye symptom. (Linked to SLO 2.4)
4. Describe the symptom pattern generally suggesting allergic conjunctivitis. (Linked to SLO 2.5)
5. Describe the symptom pattern generally suggesting a more serious underlying cause of red eye. (Linked to SLO 2.5)



2.3 Differentiating and Interpreting the Red Eye

2.3.1 steps to differentiate red eye

A systematic sequence from history through examination

Systematic differentiation of red eye begins with careful **history taking**, discussed in relation to ophthalmic history in an earlier related course, followed by **visual acuity** testing, discussed earlier in this Series, performed before any other examination **component**.

Examination should then proceed to assessment of the **pattern of injection**, discussed further in the next sub-Part, pupillary examination, discussed in an earlier related course, and, where available, corneal assessment with fluorescein staining, together building a comprehensive clinical **picture**.

Fill in the blank: Systematic differentiation of red eye begins with careful history taking, followed by visual acuity testing, performed before any other examination _____.

2.3.2 differentiating ciliary from conjunctival injection

Conjunctival injection appears as generalised redness, most pronounced peripherally and fading toward the corneal limbus, discussed in relation to limbal anatomy in the previous Series of this course, generally associated with more benign, superficial conditions such as conjunctivitis.

Ciliary injection, by contrast, appears as a violaceous ring of redness concentrated around the corneal limbus, reflecting deeper vascular involvement, and generally associated with more serious intraocular conditions, meaning careful distinction between these two injection patterns represents an essential diagnostic **step**.

Fill in the blank: Ciliary injection appears as a violaceous ring of redness concentrated around the corneal limbus, reflecting deeper vascular _____.

2.3.3 interpreting findings in the red eye

Interpreting red eye findings requires **synthesis** of the history, discussed earlier in this Part, symptom pattern, discussed earlier in this Series, and specific examination findings, including the injection pattern discussed earlier in this Part, rather than relying on any single finding in **isolation**.

Where findings suggest a genuinely more serious underlying cause, discussed throughout this Series, or where diagnostic uncertainty remains despite careful systematic assessment, prompt



referral for further specialist ophthalmic evaluation represents the appropriate, genuinely safe clinical **response**.

Fill in the blank: Where findings suggest a genuinely more serious underlying cause, or where diagnostic uncertainty remains, prompt referral for further specialist ophthalmic evaluation represents the appropriate, genuinely safe clinical _____.

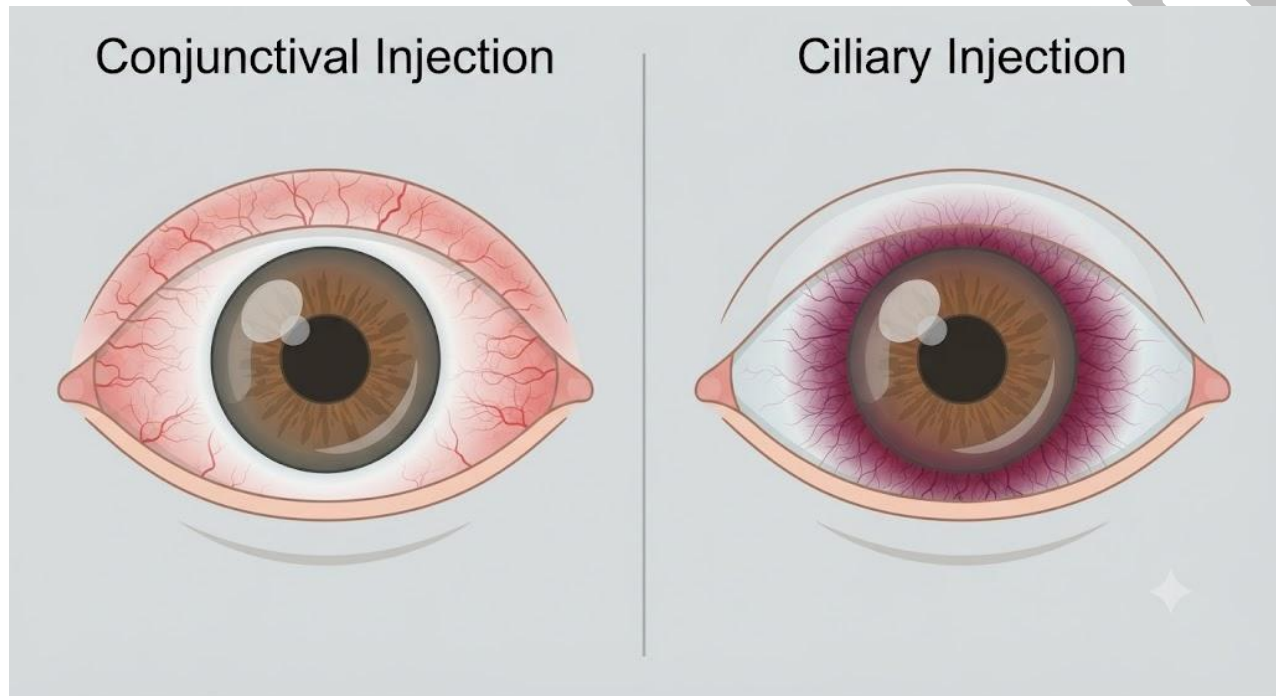


Figure 2.3: Diagram comparing conjunctival injection, most pronounced peripherally, with ciliary injection, concentrated around the corneal limbus.

Pilot questions 2.3

1. Describe the systematic sequence for differentiating red eye. (Linked to SLO 2.5)
2. Explain why visual acuity should be tested before other examination components. (Linked to SLO 2.5)
3. Distinguish conjunctival from ciliary injection. (Linked to SLO 2.6)
4. Explain why interpreting red eye findings requires synthesis rather than reliance on a single finding. (Linked to SLO 2.6)
5. Describe the appropriate response when findings suggest a serious underlying cause or diagnostic uncertainty remains. (Linked to SLO 2.6)



Series Summary

This Series examined **tear physiology and the red eye**, beginning with **tear film production and drainage**, its composition, production, and the role of the blink cycle, before examining **causes and symptoms of red eye**, common causes, associated symptoms, and relating symptoms to likely underlying cause.

We concluded with **differentiating and interpreting the red eye**, the systematic steps of assessment, differentiating ciliary from conjunctival injection, and interpreting overall findings. Having worked through this Series, you should now be equipped to understand eyelid malpositions examined in the next Series of this course.

Glossary of Terms

1. **Lipid layer:** the outer tear film layer, produced by the meibomian glands, reducing evaporation.
2. **Mucin layer:** the innermost tear film layer, produced by goblet cells, allowing even ocular surface wetting.
3. **Basal tear secretion:** continuous baseline tear production by accessory lacrimal glands.
4. **Reflex tear secretion:** increased tear production by the main lacrimal gland in response to irritation or emotion.
5. **Conjunctivitis:** inflammation of the conjunctiva, a common cause of red eye.
6. **Subconjunctival haemorrhage:** bleeding beneath the conjunctiva, a common, generally benign cause of red eye.
7. **Foreign body sensation:** the perception of a foreign object on the ocular surface, a common red eye symptom.
8. **Photophobia:** abnormal sensitivity to light, a symptom suggesting more significant ocular pathology.
9. **Conjunctival injection:** generalised redness of the conjunctiva, most pronounced peripherally.
10. **Ciliary injection:** a violaceous ring of redness concentrated around the corneal limbus, indicating deeper disease.
11. **Fluorescein staining:** a diagnostic dye used to highlight corneal epithelial defects.
12. **Symptom pattern recognition:** correlating specific symptom combinations with likely underlying diagnosis.



Concept Check Questions [Series 2]

Objective questions

1. The innermost mucin layer, produced by conjunctival goblet cells, allows the otherwise hydrophobic corneal epithelial surface to be evenly wetted by the overlying aqueous _____.
2. Contraction of the orbicularis oculi muscle generates a pumping action that draws tears into the canaliculi and toward the lacrimal _____.
3. Further important symptoms associated with red eye include pain, photophobia, and reduced visual _____.
4. Ciliary injection appears as a violaceous ring of redness concentrated around the corneal limbus, reflecting deeper vascular _____.
5. Where findings suggest a genuinely more serious underlying cause, prompt referral for further specialist ophthalmic evaluation represents the appropriate, genuinely safe clinical _____.

Short-answer questions

- List the three layers of the tear film and their source.
- Distinguish basal from reflex tear secretion.
- List common causes of red eye.
- Explain the diagnostic significance of pain as a red eye symptom.
- Distinguish conjunctival from ciliary injection.

Long-answer questions

1. Discuss the composition and production of the tear film. (Linked to SLO 2.1)
2. Discuss tear drainage and the blink cycle. (Linked to SLO 2.2)
3. Discuss common causes and symptoms of red eye. (Linked to SLO 2.3, SLO 2.4)
4. Discuss the steps used to differentiate the causes of red eye. (Linked to SLO 2.5)
5. Discuss differentiating ciliary from conjunctival injection and interpreting findings in the red eye. (Linked to SLO 2.6)

Answers to Concept Check Questions [Series 2]

Objective questions

6. Layer.
7. Sac.



8. Acuity.
9. Involvement.
10. Response.

Short-answer questions

11. Lipid layer from meibomian glands, aqueous layer from lacrimal glands, and mucin layer from goblet cells.
12. Basal secretion is continuous baseline production by accessory glands; reflex secretion is increased production by the main lacrimal gland in response to stimulus.
13. Conjunctivitis, subconjunctival haemorrhage, dry eye disease, blepharitis, and corneal conditions, among others such as uveitis or acute glaucoma.
14. Pain generally suggests corneal or intraocular involvement rather than simple conjunctival disease.
15. Conjunctival injection is generalised, more pronounced peripherally; ciliary injection is a violaceous ring concentrated around the limbus.

Long-answer questions

16. **Basic response:** The tear film comprises lipid, aqueous, and mucin layers, each with a specific source and function supporting ocular surface health.

Value-added response: Tear production combines continuous basal secretion with reflex secretion in response to irritation or emotion, influenced by autonomic innervation.

17. **Basic response:** Tear drainage occurs via the lacrimal drainage pathway, actively assisted by the pumping action of orbicularis oculi contraction during blinking.

Value-added response: Impaired blink function can therefore disrupt both tear film distribution and drainage, contributing to ocular surface disease.

18. **Basic response:** Common causes of red eye include conjunctivitis, subconjunctival haemorrhage, dry eye, and less commonly, more serious intraocular causes.

Value-added response: Associated symptoms, including itching, discharge, pain, and photophobia, each carry diagnostic relevance to the underlying category of disease.

19. **Basic response:** Systematic differentiation begins with history and visual acuity testing before other examination, followed by assessment of injection pattern and pupillary and corneal findings.



Value-added response: This structured sequence supports efficient, reliable distinction between benign and potentially serious causes of red eye.

20. **Basic response:** Ciliary injection, a limbal ring, indicates deeper disease, while conjunctival injection is more peripheral and generally benign.

Value-added response: Interpreting findings requires synthesising history, symptoms, and examination together, with prompt referral where uncertainty or concerning features remain.

Answers to Pilot Questions [Series 2]

Part 2.1

11. Lipid layer from meibomian glands, aqueous layer from lacrimal glands, and mucin layer from goblet cells.
12. It allows the otherwise hydrophobic corneal surface to be evenly wetted by the overlying aqueous layer.
13. Basal secretion is continuous, from accessory glands; reflex secretion is increased, from the main lacrimal gland in response to stimulus.
14. Parasympathetic stimulation promotes lacrimal gland secretion.
15. Orbicularis oculi contraction during blinking generates a pumping action drawing tears into the canaliculi toward the lacrimal sac.

Part 2.2

1. Conjunctivitis, subconjunctival haemorrhage, and dry eye disease, among others such as blepharitis or corneal conditions.
2. Itching, discharge, foreign body sensation, pain, photophobia, and reduced visual acuity.
3. It generally suggests corneal or intraocular involvement rather than simple conjunctival disease.
4. Itching and watery discharge.
5. Significant pain, photophobia, and reduced visual acuity.

Part 2.3

6. History taking, then visual acuity testing, followed by examination of injection pattern, pupils, and cornea.



7. Because subsequent examination or intervention should not delay or interfere with an accurate baseline visual acuity measurement.
8. Conjunctival injection is generalised and peripheral; ciliary injection is a violaceous limbal ring indicating deeper disease.
9. Because relying on a single finding risks missing important diagnostic information only apparent when findings are considered together.
10. Prompt referral for further specialist ophthalmic evaluation.

References and Attributions [Series 2]

11. Kanski, J. J., & Bowling, B. (2015). *Clinical Ophthalmology: A Systematic Approach* (8th ed.). Elsevier.
12. Leibowitz, H. M. (2000). The Red Eye. *New England Journal of Medicine*, 343(5), 345-351.
13. Khurana, A. K. (2019). *Comprehensive Ophthalmology* (7th ed.). Jaypee Brothers Medical Publishers.
14. Riordan-Eva, P., & Augsburger, J. J. (Eds.). (2017). *Vaughan and Asbury's General Ophthalmology* (19th ed.). McGraw-Hill.

Figures, Plates, Tables, and Boxes

1. Table 2.1: The three layers of the tear film. AI-generated using the prompt: "Create a clean physiology reference table titled The Three Layers of the Tear Film, listing layer, source, and primary function. Ophthalmology reference table style with outside border, no photographic elements."
2. Table 2.2: Relating red eye symptoms to likely underlying cause. AI-generated using the prompt: "Create a clean clinical reference table titled Relating Red Eye Symptoms to Likely Underlying Cause, listing symptom pattern, suggested cause, and level of concern. Ophthalmology reference table style with outside border, no photographic elements."
3. Figure 2.3: Diagram comparing conjunctival injection, most pronounced peripherally, with ciliary injection, concentrated around the corneal limbus. AI-generated using the prompt: "A single clean, accurate two-panel schematic diagram of a front-facing eye, one panel labelled conjunctival injection showing diffuse peripheral redness fading toward the limbus, the other labelled ciliary injection showing a concentrated violaceous ring around the limbus, textbook clinical diagram style, neutral background, no photographic realism, no other panels."



Course code: OPT 603

Course title: Cornea, External Eye Diseases, Lacrimal System, Orbit

Course credit load: 1 Unit

Series 3: Eyelid Malpositions

- **Part 3.1: Ptosis**
 - Sub Part 3.1.1: Definition and classification of ptosis
 - Sub Part 3.1.2: Clinical assessment of ptosis
 - Sub Part 3.1.3: Causes and management of ptosis
- **Part 3.2: Ectropion and Entropion**
 - Sub Part 3.2.1: Ectropion: definition, causes, and features
 - Sub Part 3.2.2: Entropion: definition, causes, and features
 - Sub Part 3.2.3: Comparing ectropion and entropion
- **Part 3.3: Eyelid Retraction and Lagophthalmos**
 - Sub Part 3.3.1: Eyelid retraction: definition and causes
 - Sub Part 3.3.2: Lagophthalmos: definition and causes
 - Sub Part 3.3.3: Complications of eyelid malposition affecting ocular surface protection

Introduction

In the last Series, we established tear physiology and the red eye. We now turn to **eyelid malpositions**, abnormalities of eyelid position that can significantly affect both cosmesis and, more importantly, ocular surface protection, spanning **ptosis**, **ectropion and entropion**, and **eyelid retraction and lagophthalmos**, each carrying distinct clinical implications.

The aim of this Series is to equip you with a thorough understanding of eyelid malpositions, including ptosis, ectropion, entropion, retraction, and lagophthalmos.

This Series begins with **ptosis**, before examining **ectropion and entropion**. It concludes with **eyelid retraction and lagophthalmos**.



Series Learning Outcomes

At the end of this Series, you should be able to:

- **SLO 3.1:** define and classify ptosis
- **SLO 3.2:** describe the clinical assessment, causes, and management of ptosis
- **SLO 3.3:** define ectropion and entropion and describe their causes and features
- **SLO 3.4:** compare ectropion and entropion
- **SLO 3.5:** define eyelid retraction and lagophthalmos and describe their causes, and
- **SLO 3.6:** describe the complications of eyelid malposition affecting ocular surface protection.

3.1 Ptosis

3.1.1 definition and classification of ptosis

Abnormal drooping of the upper eyelid

Ptosis refers to abnormal drooping of the upper eyelid, discussed in relation to normal eyelid position and elevator function in an earlier Series of this course, potentially affecting one or both eyes, and ranging in severity from mild to complete visual axis **obstruction**.

Ptosis is broadly classified as **congenital**, present from birth, generally resulting from levator muscle dysgenesis, or **acquired**, developing later in life, discussed further in the next sub-Part, with further subclassification according to the specific underlying **mechanism** involved.

Fill in the blank: Ptosis is broadly classified as congenital, present from birth, or acquired, developing later in life, with further subclassification according to the specific underlying _____ involved.

3.1.2 clinical assessment of ptosis

Clinical assessment of ptosis, discussed in relation to eyelid position measurement further in this course, generally includes measurement of the **margin reflex distance**, the distance between the upper lid margin and the corneal light reflex, discussed further in a later Series of this course.



Further important assessment includes measurement of **levator function**, discussed in relation to levator palpebrae superioris anatomy in an earlier Series of this course, assessing the range of upper lid excursion from downgaze to upgaze, since this measurement directly informs the most appropriate surgical approach where **intervention** is required.

Fill in the blank: Clinical assessment of ptosis includes measurement of levator function, assessing the range of upper lid excursion from downgaze to upgaze, since this measurement directly informs the most appropriate surgical _____ where intervention is required.

3.1.3 causes and management of ptosis

Recognised causes of acquired ptosis include **aponeurotic** ptosis, resulting from stretching or dehiscence of the levator aponeurosis, discussed in relation to levator anatomy earlier in this Series, generally age-related, and **neurogenic** ptosis, resulting from oculomotor nerve palsy or Horner's syndrome, discussed in relation to sympathetic innervation earlier in this course.

Management of ptosis, discussed throughout this Part, depends substantially on the specific underlying cause and severity, ranging from observation for mild cases without visual axis compromise to surgical **correction**, generally reserved for cases with genuine functional or, in children, amblyogenic **risk**.

Fill in the blank: Management of ptosis depends substantially on the specific underlying cause and severity, ranging from observation to surgical correction, generally reserved for cases with genuine functional or amblyogenic _____.



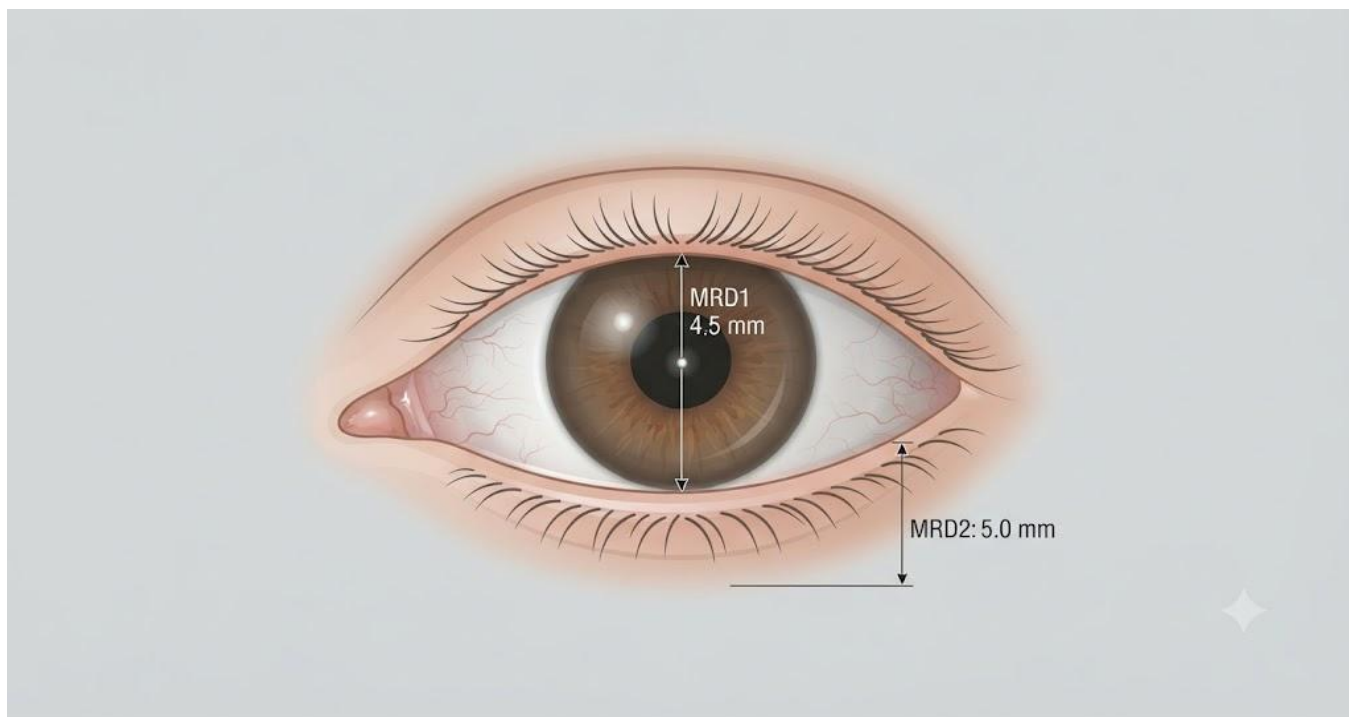


Figure 3.1: Diagram illustrating measurement of margin reflex distance as part of ptosis assessment.

Pilot questions 3.1

- Define ptosis. (Linked to SLO 3.1)
- Distinguish congenital from acquired ptosis. (Linked to SLO 3.1)
- Define margin reflex distance. (Linked to SLO 3.2)
- Explain why levator function measurement is important in ptosis assessment. (Linked to SLO 3.2)
- Distinguish aponeurotic from neurogenic ptosis. (Linked to SLO 3.2)

3.2 Ectropion and Entropion

3.2.1 ectropion: definition, causes, and features

Outward eversion of the eyelid margin

Ectropion refers to outward eversion of the eyelid margin, discussed in relation to normal eyelid position in an earlier Series of this course, most commonly affecting the lower lid, generally



resulting from age-related tissue laxity, or **involutional** ectropion, the most common recognised cause.

Further recognised causes include **cicatricial** ectropion, resulting from scarring pulling the lid margin outward, and **paralytic** ectropion, resulting from facial nerve palsy, discussed in relation to orbicularis oculi innervation earlier in this course, with exposed palpebral conjunctiva and epiphora, or excessive tearing, representing characteristic clinical **features**.

Fill in the blank: Ectropion refers to outward eversion of the eyelid margin, most commonly affecting the lower lid, with exposed palpebral conjunctiva and epiphora representing characteristic clinical _____.

3.2.2 entropion: definition, causes, and features

Entropion refers to inward turning of the eyelid margin, discussed in relation to normal eyelid position in an earlier Series of this course, again most commonly affecting the lower lid, generally resulting from age-related tissue laxity, or **involutional** entropion, the most common recognised cause.

Further recognised causes include **cicatricial** entropion, resulting from scarring within the posterior lamella pulling the lid margin inward, and **spastic** entropion, resulting from orbicularis oculi spasm, with the inward-turning lashes producing corneal irritation and, if prolonged, corneal epithelial **damage**.

Fill in the blank: Entropion refers to inward turning of the eyelid margin, with the inward-turning lashes producing corneal irritation and, if prolonged, corneal epithelial _____.

3.2.3 comparing ectropion and entropion

Ectropion and entropion, discussed throughout this Part, represent essentially opposite eyelid malposition directions, both frequently sharing **involutional** age-related tissue laxity as their most common underlying cause, though producing genuinely distinct clinical **consequences**.

Ectropion primarily produces symptoms related to inadequate ocular surface coverage and excessive tear exposure, discussed earlier in this Part, while entropion primarily produces symptoms related to mechanical corneal irritation from misdirected **eyelashes**, meaning careful clinical distinction directly guides the specific corrective surgical approach required.

Fill in the blank: Ectropion primarily produces symptoms related to inadequate ocular surface coverage, while entropion primarily produces symptoms related to mechanical corneal irritation from misdirected _____.



Table 3.2: Comparing ectropion and entropion.

Feature	Ectropion	Entropion
Direction of margin displacement	Outward eversion	Inward turning
Most common cause	Involutional (age-related laxity)	Involutional (age-related laxity)
Primary symptom mechanism	Exposed conjunctiva and epiphora	Lash-related corneal irritation

Pilot questions 3.2

1. Define ectropion. (Linked to SLO 3.3)
2. List the causes of ectropion. (Linked to SLO 3.3)
3. Define entropion. (Linked to SLO 3.3)
4. List the causes of entropion. (Linked to SLO 3.3)
5. Compare the primary symptom mechanism of ectropion and entropion. (Linked to SLO 3.4)

3.3 Eyelid Retraction and Lagophthalmos

3.3.1 eyelid retraction: definition and causes

Abnormal elevation exposing more sclera than normal

Eyelid retraction refers to abnormal elevation of the upper eyelid margin, or, less commonly, abnormal depression of the lower eyelid margin, discussed in relation to normal lid position in an earlier Series of this course, producing visible sclera above or below the corneal limbus.

The most commonly recognised cause of eyelid retraction is **thyroid eye disease**, discussed further in a later Series of this course, though further recognised causes include neurogenic causes and, less commonly, mechanical causes such as prior eyelid **surgery**.

Fill in the blank: Eyelid retraction refers to abnormal elevation of the upper eyelid margin, producing visible sclera above the corneal _____.



3.3.2 lagophthalmos: definition and causes

Lagophthalmos refers to incomplete eyelid closure, discussed in relation to orbicularis oculi function in an earlier Series of this course, most commonly resulting from **facial nerve palsy**, though also occurring with severe proptosis, discussed further in a later Series of this course, or significant eyelid scarring or retraction.

Lagophthalmos may be present only during **sleep**, termed nocturnal lagophthalmos, or persist throughout waking hours in more severe cases, with the specific degree and pattern of incomplete closure directly influencing the resulting risk to ocular surface **protection**, discussed further in the next sub-Part.

Fill in the blank: Lagophthalmos may be present only during sleep, termed nocturnal lagophthalmos, or persist throughout waking hours in more severe _____.

3.3.3 complications of eyelid malposition affecting ocular surface protection

Both eyelid retraction and lagophthalmos, discussed throughout this Part, share the potential to produce inadequate corneal coverage and consequent **exposure keratopathy**, discussed in relation to corneal epithelial integrity in an earlier Series of this course, ranging from mild punctate epithelial changes to severe corneal ulceration.

Prompt recognition of these malpositions, discussed throughout this Part, and appropriate protective measures, including lubricating ointment and, where severe, taping or surgical intervention, are essential to preventing progression to sight-threatening corneal **complications**, particularly relevant in patients with reduced corneal sensation or protective blink reflex.

Fill in the blank: Prompt recognition of eyelid malposition and appropriate protective measures are essential to preventing progression to sight-threatening corneal _____.

Table 3.3: Comparing eyelid retraction and lagophthalmos.

Feature	Eyelid retraction	Lagophthalmos
Definition	Abnormal upper lid elevation exposing sclera	Incomplete eyelid closure
Most common cause	Thyroid eye disease	Facial nerve palsy
Shared risk	Exposure keratopathy from inadequate corneal coverage	Exposure keratopathy from inadequate corneal coverage



Pilot questions 3.3

1. Define eyelid retraction and state its most common cause. (Linked to SLO 3.5)
2. Define lagophthalmos and state its most common cause. (Linked to SLO 3.5)
3. Define nocturnal lagophthalmos. (Linked to SLO 3.5)
4. Define exposure keratopathy and explain its relevance to eyelid malposition. (Linked to SLO 3.6)
5. Describe protective measures for patients with lagophthalmos or retraction. (Linked to SLO 3.6)

Series Summary

This Series examined **eyelid malpositions**, beginning with **ptosis**, its definition, classification, assessment, causes, and management, before examining **ectropion and entropion**, their definitions, causes, features, and comparison.

We concluded with **eyelid retraction and lagophthalmos**, their definitions, causes, and the shared complication of exposure keratopathy. Having worked through this Series, you should now be equipped to understand inflammatory and infective eyelid disease and nasolacrimal duct obstruction examined in the next Series of this course.

Glossary of Terms

1. **Ptosis:** abnormal drooping of the upper eyelid.
2. **Margin reflex distance:** the distance between the upper eyelid margin and the corneal light reflex.
3. **Aponeurotic ptosis:** ptosis resulting from stretching or dehiscence of the levator aponeurosis.
4. **Ectropion:** outward eversion of the eyelid margin.
5. **Entropion:** inward turning of the eyelid margin.
6. **Involuntional:** age-related, describing the most common cause of both ectropion and entropion.
7. **Cicatricial:** resulting from scarring, a recognised cause of both ectropion and entropion.
8. **Eyelid retraction:** abnormal elevation of the upper eyelid margin, or depression of the lower margin, exposing sclera.



9. **Lagophthalmos:** incomplete eyelid closure.
10. **Nocturnal lagophthalmos:** incomplete eyelid closure occurring specifically during sleep.
11. **Exposure keratopathy:** corneal epithelial damage resulting from inadequate corneal coverage.
12. **Facial nerve palsy:** weakness of facial nerve function, a common cause of lagophthalmos and paralytic ectropion.

Concept Check Questions [Series 3]

Objective questions

1. Ptosis is broadly classified as congenital, present from birth, or acquired, developing later in life, with further subclassification according to the specific underlying _____ involved.
2. Ectropion refers to outward eversion of the eyelid margin, with exposed palpebral conjunctiva and epiphora representing characteristic clinical _____.
3. Entropion refers to inward turning of the eyelid margin, with the inward-turning lashes producing corneal irritation and, if prolonged, corneal epithelial _____.
4. Eyelid retraction refers to abnormal elevation of the upper eyelid margin, producing visible sclera above the corneal _____.
5. Prompt recognition of eyelid malposition and appropriate protective measures are essential to preventing progression to sight-threatening corneal _____.

Short-answer questions

- Distinguish congenital from acquired ptosis.
- Distinguish aponeurotic from neurogenic ptosis.
- Compare the primary symptom mechanism of ectropion and entropion.
- Define lagophthalmos and state its most common cause.
- Define exposure keratopathy and explain its relevance to eyelid malposition.

Long-answer questions

1. Discuss the definition, classification, clinical assessment, causes, and management of ptosis. (Linked to SLO 3.1, SLO 3.2)
2. Discuss the definition, causes, and features of ectropion. (Linked to SLO 3.3)
3. Discuss the definition, causes, and features of entropion, and compare it with ectropion. (Linked to SLO 3.3, SLO 3.4)



4. Discuss the definition and causes of eyelid retraction and lagophthalmos. (Linked to SLO 3.5)
5. Discuss the complications of eyelid malposition affecting ocular surface protection. (Linked to SLO 3.6)

Answers to Concept Check Questions [Series 3]

Objective questions

6. Mechanism.
7. Features.
8. Damage.
9. Limbus.
10. Complications.

Short-answer questions

11. Congenital ptosis is present from birth, generally from levator dysgenesis; acquired ptosis develops later in life.
12. Aponeurotic ptosis results from levator aponeurosis stretching or dehiscence; neurogenic ptosis results from oculomotor palsy or Horner's syndrome.
13. Ectropion produces symptoms from inadequate ocular surface coverage and tear exposure; entropion produces symptoms from lash-related corneal irritation.
14. Incomplete eyelid closure; most commonly caused by facial nerve palsy.
15. Corneal epithelial damage from inadequate corneal coverage; it is a shared risk of both eyelid retraction and lagophthalmos.

Long-answer questions

16. **Basic response:** Ptosis is abnormal upper lid drooping, classified as congenital or acquired, assessed by margin reflex distance and levator function.

Value-added response: Management depends on the underlying cause and severity, ranging from observation to surgical correction where functional or amblyogenic risk exists.

17. **Basic response:** Ectropion is outward eyelid margin eversion, most commonly involutional, with cicatricial and paralytic causes also recognised.

Value-added response: Its primary consequence is exposed conjunctiva and epiphora from inadequate ocular surface coverage.



18. **Basic response:** Entropion is inward eyelid margin turning, most commonly involutional, with cicatricial and spastic causes also recognised.

Value-added response: Unlike ectropion, entropion primarily causes corneal irritation from misdirected lashes, guiding a distinct corrective surgical approach.

19. **Basic response:** Eyelid retraction is abnormal lid elevation exposing sclera, most commonly from thyroid eye disease; lagophthalmos is incomplete closure, most commonly from facial nerve palsy.

Value-added response: Both may occur only during sleep or persist throughout waking hours, depending on severity.

20. **Basic response:** Both retraction and lagophthalmos risk inadequate corneal coverage and exposure keratopathy, ranging from mild changes to severe ulceration.

Value-added response: Prompt recognition and protective measures, including lubrication and, where needed, surgical intervention, are essential to preventing sight-threatening complications.

Answers to Pilot Questions [Series 3]

Part 3.1

11. Abnormal drooping of the upper eyelid.
12. Congenital ptosis is present from birth, generally from levator dysgenesis; acquired ptosis develops later in life.
13. The distance between the upper eyelid margin and the corneal light reflex.
14. Because it directly informs the most appropriate surgical approach where intervention is required.
15. Aponeurotic ptosis results from levator aponeurosis stretching or dehiscence; neurogenic ptosis results from oculomotor palsy or Horner's syndrome.

Part 3.2

1. Outward eversion of the eyelid margin.
2. Involutional (age-related), cicatricial, and paralytic.
3. Inward turning of the eyelid margin.
4. Involutional (age-related), cicatricial, and spastic.



5. Ectropion causes symptoms from inadequate ocular surface coverage; entropion causes symptoms from lash-related corneal irritation.

Part 3.3

6. Abnormal elevation of the upper eyelid margin exposing sclera; most commonly caused by thyroid eye disease.
7. Incomplete eyelid closure; most commonly caused by facial nerve palsy.
8. Incomplete eyelid closure occurring specifically during sleep.
9. Corneal epithelial damage from inadequate corneal coverage; both retraction and lagophthalmos carry this risk.
10. Lubricating ointment, and, where severe, taping or surgical intervention.

References and Attributions [Series 3]

11. Kanski, J. J., & Bowling, B. (2015). Clinical Ophthalmology: A Systematic Approach (8th ed.). Elsevier.
12. Collin, J. R. O. (2006). A Manual of Systematic Eyelid Surgery (3rd ed.). Elsevier.
13. Khurana, A. K. (2019). Comprehensive Ophthalmology (7th ed.). Jaypee Brothers Medical Publishers.
14. Riordan-Eva, P., & Augsburger, J. J. (Eds.). (2017). Vaughan and Asbury's General Ophthalmology (19th ed.). McGraw-Hill.

Figures, Plates, Tables, and Boxes

1. Figure 3.1: Diagram illustrating measurement of margin reflex distance as part of ptosis assessment. AI-generated using the prompt: "A single clean, clinically accurate illustration of a front-facing eye with a small light reflex visible on the cornea and a labelled measurement line from the upper eyelid margin down to that reflex point, medical textbook diagram style, neutral background, no photographic realism, no other panels."
2. Table 3.2: Comparing ectropion and entropion. AI-generated using the prompt: "Create a clean clinical reference table titled Comparing Ectropion and Entropion, listing feature, ectropion, and entropion. Ophthalmology reference table style with outside border, no photographic elements."



3. Table 3.3: Comparing eyelid retraction and lagophthalmos. AI-generated using the prompt: "Create a clean clinical reference table titled Comparing Eyelid Retraction and Lagophthalmos, listing feature, eyelid retraction, and lagophthalmos. Ophthalmology reference table style with outside border, no photographic elements."



Course code: OPT 603

Course title: Cornea, External Eye Diseases, Lacrimal System, Orbit

Course credit load: 1 Unit

Series 4: Inflammatory and Infective Eyelid Disease and Nasolacrimal Duct Obstruction

- **Part 4.1: Inflammatory Eyelid Disease**
 - Sub Part 4.1.1: Chalazion
 - Sub Part 4.1.2: Blepharitis: types and features
 - Sub Part 4.1.3: Management of blepharitis
- **Part 4.2: Infective Eyelid Disease: Hordeolum**
 - Sub Part 4.2.1: External hordeolum (stye)
 - Sub Part 4.2.2: Internal hordeolum
 - Sub Part 4.2.3: Comparing chalazion and hordeolum
- **Part 4.3: Nasolacrimal Duct Obstruction**
 - Sub Part 4.3.1: Causes of nasolacrimal duct obstruction
 - Sub Part 4.3.2: Clinical features of nasolacrimal duct obstruction
 - Sub Part 4.3.3: Management of nasolacrimal duct obstruction

Introduction

In the last Series, we established eyelid malpositions. We now turn to **inflammatory and infective eyelid disease**, chalazion, blepharitis, and hordeolum, common conditions frequently encountered in everyday ophthalmic practice, together with **nasolacrimal duct obstruction**, a further common cause of ocular surface symptoms relevant to the lacrimal drainage system established earlier in this course.

The aim of this Series is to equip you with a thorough understanding of eyelid inflammations, including chalazion and blepharitis, eyelid infections, including hordeolum, and nasolacrimal duct obstruction.



This Series begins with **inflammatory eyelid disease**, before examining **infective eyelid disease: hordeolum**. It concludes with **nasolacrimal duct obstruction**.

Series Learning Outcomes

At the end of this Series, you should be able to:

- **SLO 4.1:** describe chalazion and its clinical features
- **SLO 4.2:** describe the types, features, and management of blepharitis
- **SLO 4.3:** describe external and internal hordeolum and compare them with chalazion
- **SLO 4.4:** compare chalazion and hordeolum
- **SLO 4.5:** describe the causes and clinical features of nasolacrimal duct obstruction, and
- **SLO 4.6:** describe the management of nasolacrimal duct obstruction.

4.1 Inflammatory Eyelid Disease

4.1.1 chalazion

A chronic granulomatous reaction to obstructed meibomian secretion

A **chalazion** results from obstruction and subsequent granulomatous inflammation of a **meibomian gland**, discussed in relation to eyelid margin anatomy in an earlier Series of this course, presenting as a firm, generally painless nodule within the tarsal plate, discussed in relation to eyelid structure in an earlier Series of this course.

Unlike acute infective processes discussed further later in this Series, a chalazion generally lacks significant surrounding erythema or **tenderness**, reflecting its chronic, sterile, granulomatous nature, though secondary infection can occasionally complicate an otherwise typical chalazion **presentation**.

Fill in the blank: A chalazion generally lacks significant surrounding erythema or tenderness, reflecting its chronic, sterile, granulomatous nature, though secondary infection can occasionally complicate an otherwise typical chalazion _____.



4.1.2 blepharitis: types and features

Blepharitis, chronic inflammation of the eyelid margin, discussed in relation to eyelid margin anatomy in an earlier Series of this course, is broadly classified as **anterior**, involving the lash follicles and associated glands of Zeis and Moll, or **posterior**, involving meibomian gland dysfunction, discussed earlier in this Part.

Characteristic features of blepharitis include eyelid margin **crusting**, redness, and irritation, together with associated dry eye symptoms, discussed in relation to tear film composition in an earlier Series of this course, given the frequent coexistence of meibomian gland dysfunction and impaired tear film **stability**.

Fill in the blank: Blepharitis is broadly classified as anterior, involving the lash follicles, or posterior, involving meibomian gland _____.

4.1.3 management of blepharitis

Management of blepharitis, discussed earlier in this Part, centres on **eyelid hygiene**, including regular warm compresses to soften meibomian gland secretions and gentle lid margin cleaning, forming the essential foundation of treatment regardless of the specific blepharitis **subtype**.

Further management, where indicated, includes topical **antibiotic** therapy for significant anterior blepharitis, and, for chronic or severe cases, consideration of oral therapy, with management generally requiring a sustained, ongoing approach given the genuinely chronic, relapsing-remitting natural history characteristic of this **condition**.

Fill in the blank: Management of blepharitis generally requires a sustained, ongoing approach given the genuinely chronic, relapsing-remitting natural history characteristic of this _____.



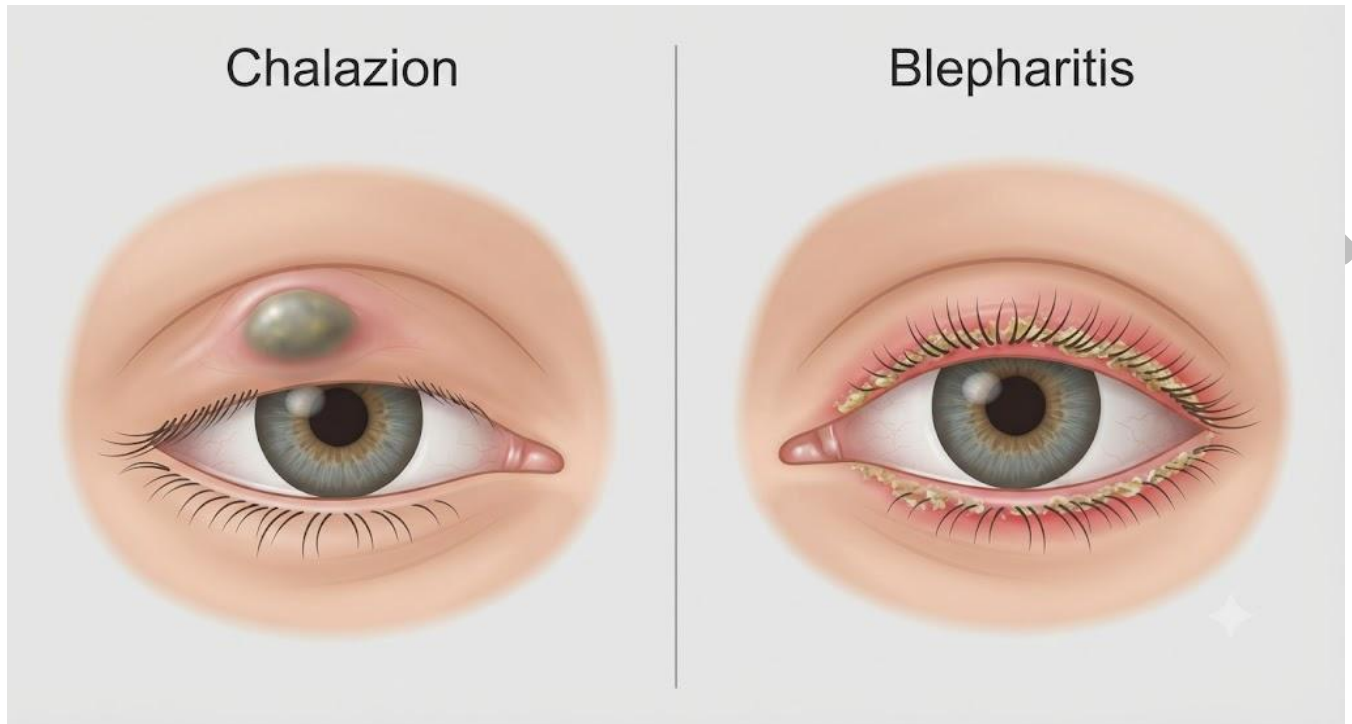


Figure 4.1: Diagram comparing the appearance of a firm, painless chalazion nodule with the crusting and redness of blepharitis along the eyelid margin.

Pilot questions 4.1

- Define chalazion and describe its typical clinical presentation. (Linked to SLO 4.1)
- Explain why a chalazion generally lacks significant erythema or tenderness. (Linked to SLO 4.1)
- Distinguish anterior from posterior blepharitis. (Linked to SLO 4.2)
- Describe the characteristic features of blepharitis. (Linked to SLO 4.2)
- Describe the management of blepharitis. (Linked to SLO 4.2)

4.2 Infective Eyelid Disease: Hordeolum

4.2.1 external hordeolum (stye)

An acute infection of the superficial eyelid glands

An **external hordeolum**, commonly termed a **stye**, results from acute bacterial infection of the glands of Zeis or Moll, discussed in relation to eyelid margin anatomy in an earlier Series of this course, presenting as a painful, erythematous, localised swelling at the eyelid margin.



Staphylococcus aureus represents the most common causative organism, discussed in relation to bacterial infection in an earlier related course, with the acute lesion generally pointing toward the skin surface, in distinct contrast to the internal hordeolum discussed in the next sub-Part.

Fill in the blank: An external hordeolum, commonly termed a sty, results from acute bacterial infection of the glands of Zeis or Moll, with the acute lesion generally pointing toward the skin _____.

4.2.2 internal hordeolum

An **internal hordeolum**, discussed in relation to external hordeolum earlier in this Part, results from acute infection of a **meibomian gland**, discussed in relation to meibomian gland anatomy in an earlier Series of this course, presenting as a painful, erythematous swelling deeper within the tarsal plate.

Unlike the external hordeolum, discussed earlier in this Part, which points toward the skin surface, an internal hordeolum more typically points toward the **conjunctival** surface, reflecting the deeper anatomical location of the infected meibomian gland within the tarsal **plate**.

Fill in the blank: Unlike the external hordeolum, which points toward the skin surface, an internal hordeolum more typically points toward the _____ surface.

4.2.3 comparing chalazion and hordeolum

Chalazion, discussed earlier in this Series, and **hordeolum**, discussed throughout this Part, both involve the meibomian or associated eyelid glands, though chalazion represents a chronic, sterile granulomatous process, while hordeolum represents an acute, **infective** process, meaning their clinical presentation differs substantially despite this shared anatomical **origin**.

This distinction carries direct management relevance, since acute hordeolum, discussed throughout this Part, generally responds to warm compresses and, where indicated, antibiotic therapy, while a chronic, non-resolving chalazion, discussed earlier in this Series, may ultimately require surgical **incision** and curettage.

Fill in the blank: This distinction between chalazion and hordeolum carries direct management relevance, since a chronic, non-resolving chalazion may ultimately require surgical incision and _____.



Table 4.2: Comparing chalazion, external hordeolum, and internal hordeolum.

Condition	Nature	Typical presentation
Chalazion	Chronic, sterile granulomatous process	Firm, painless nodule
External hordeolum (stye)	Acute infection of glands of Zeis/Moll	Painful swelling pointing toward the skin
Internal hordeolum	Acute infection of a meibomian gland	Painful swelling pointing toward the conjunctiva

Pilot questions 4.2

1. Define external hordeolum (stye) and state its typical causative organism. (Linked to SLO 4.3)
2. Describe the typical presentation of an external hordeolum. (Linked to SLO 4.3)
3. Define internal hordeolum and describe how it differs from external hordeolum. (Linked to SLO 4.3)
4. Compare chalazion and hordeolum in terms of underlying nature. (Linked to SLO 4.4)
5. Explain the management relevance of distinguishing chalazion from hordeolum. (Linked to SLO 4.4)

4.3 Nasolacrimal Duct Obstruction

4.3.1 causes of nasolacrimal duct obstruction

A common cause of impaired tear drainage across the lifespan

Nasolacrimal duct obstruction, discussed in relation to lacrimal drainage anatomy in an earlier Series of this course, in infants generally results from incomplete **canalisation** at birth, most commonly at the valve of Hasner, near the duct's distal opening into the inferior nasal meatus.

In adults, nasolacrimal duct obstruction, discussed earlier in this Part, most commonly results from **involutional** age-related narrowing, though further recognised causes include prior infection, trauma, discussed in relation to ocular trauma principles in an earlier Series of this course, and, less commonly, tumour **obstruction**.

Fill in the blank: Nasolacrimal duct obstruction in infants generally results from incomplete canalisation at birth, most commonly at the valve of Hasner, near the duct's distal opening into the inferior nasal _____.



4.3.2 clinical features of nasolacrimal duct obstruction

The characteristic presenting feature of nasolacrimal duct obstruction is **epiphora**, excessive tearing, discussed in relation to lacrimal drainage physiology earlier in this course, resulting from impaired tear outflow despite normal tear **production**.

Chronic nasolacrimal duct obstruction, discussed earlier in this Part, may additionally predispose to **dacryocystitis**, infection of the lacrimal sac, presenting with pain, erythema, and swelling over the medial canthal region, occasionally with mucopurulent discharge expressible from the puncta on gentle **pressure**.

Fill in the blank: Chronic nasolacrimal duct obstruction may predispose to dacryocystitis, infection of the lacrimal sac, presenting with pain, erythema, and swelling over the medial canthal _____.

4.3.3 management of nasolacrimal duct obstruction

Management of nasolacrimal duct obstruction in infants, discussed earlier in this Part, generally begins with conservative measures, including gentle **lacrimal sac massage**, since a substantial proportion of cases resolve spontaneously with continued postnatal duct maturation within the first year of **life**.

Persistent obstruction, or obstruction in adults, discussed earlier in this Part, generally requires probing and irrigation of the nasolacrimal system, or, for more established or refractory obstruction, surgical **dacryocystorhinostomy**, creating a new drainage pathway bypassing the obstructed **segment**.

Fill in the blank: Persistent nasolacrimal duct obstruction generally requires probing and irrigation, or, for more established or refractory obstruction, surgical dacryocystorhinostomy, creating a new drainage pathway bypassing the obstructed _____.

Table 4.3: Comparing infant and adult nasolacrimal duct obstruction.

Feature	Infant obstruction	Adult obstruction
Typical cause	Incomplete canalisation, especially at the valve of Hasner	Involutional narrowing, prior infection, or trauma
Initial management	Conservative lacrimal sac massage	Probing and irrigation
Definitive surgical option	Rarely required	Dacryocystorhinostomy for refractory cases



Pilot questions 4.3

1. Describe the typical cause of nasolacrimal duct obstruction in infants. (Linked to SLO 4.5)
2. Describe the typical causes of nasolacrimal duct obstruction in adults. (Linked to SLO 4.5)
3. Define epiphora and explain its relevance to nasolacrimal duct obstruction. (Linked to SLO 4.5)
4. Define dacryocystitis and describe its typical presentation. (Linked to SLO 4.5)
5. Describe the management of nasolacrimal duct obstruction, from conservative to surgical options. (Linked to SLO 4.6)

Series Summary

This Series examined **inflammatory and infective eyelid disease and nasolacrimal duct obstruction**, beginning with **inflammatory eyelid disease**, chalazion and blepharitis, before examining **infective eyelid disease: hordeolum**, external and internal hordeolum and their comparison with chalazion.

We concluded with **nasolacrimal duct obstruction**, its causes, clinical features, and management. Having worked through this Series, you should now be equipped to understand orbital disease and clinical assessment of the cornea, proptosis, and eyelid position examined in the final Series of this course.

Glossary of Terms

1. **Chalazion:** chronic, sterile granulomatous inflammation of a meibomian gland.
2. **Blepharitis:** chronic inflammation of the eyelid margin, classified as anterior or posterior.
3. **Meibomian gland dysfunction:** impaired meibomian gland secretion, associated with posterior blepharitis and dry eye.
4. **External hordeolum (stye):** acute bacterial infection of the glands of Zeis or Moll.
5. **Internal hordeolum:** acute bacterial infection of a meibomian gland.
6. **Nasolacrimal duct obstruction:** blockage of the nasolacrimal duct impairing tear drainage.



7. **Valve of Hasner:** the distal nasolacrimal duct opening, the most common site of infant obstruction.
8. **Epiphora:** excessive tearing resulting from impaired tear outflow.
9. **Dacryocystitis:** infection of the lacrimal sac, a complication of chronic nasolacrimal duct obstruction.
10. **Lacrimal sac massage:** a conservative technique used to promote resolution of infant nasolacrimal duct obstruction.
11. **Probing and irrigation:** a procedure to clear or assess patency of an obstructed nasolacrimal duct.
12. **Dacryocystorhinostomy:** surgical creation of a new tear drainage pathway bypassing an obstructed nasolacrimal duct.

Concept Check Questions [Series 4]

Objective questions

1. A chalazion generally lacks significant surrounding erythema or tenderness, reflecting its chronic, sterile, granulomatous _____.
2. Blepharitis is broadly classified as anterior, involving the lash follicles, or posterior, involving meibomian gland _____.
3. An external hordeolum generally points toward the skin surface, while an internal hordeolum more typically points toward the _____ surface.
4. Nasolacrimal duct obstruction in infants generally results from incomplete canalisation at birth, most commonly at the valve of _____.
5. Persistent nasolacrimal duct obstruction generally requires probing and irrigation, or surgical dacryocystorhinostomy, creating a new drainage pathway bypassing the obstructed _____.

Short-answer questions

- Define chalazion and describe its typical clinical presentation.
- Describe the characteristic features of blepharitis.
- Distinguish external hordeolum from internal hordeolum.
- Compare chalazion and hordeolum in terms of underlying nature.
- Define dacryocystitis and describe its typical presentation.

Long-answer questions

1. Discuss chalazion and its clinical features. (Linked to SLO 4.1)
2. Discuss the types, features, and management of blepharitis. (Linked to SLO 4.2)



3. Discuss external and internal hordeolum and compare them with chalazion. (Linked to SLO 4.3, SLO 4.4)
4. Discuss the causes and clinical features of nasolacrimal duct obstruction. (Linked to SLO 4.5)
5. Discuss the management of nasolacrimal duct obstruction. (Linked to SLO 4.6)

Answers to Concept Check Questions [Series 4]

Objective questions

6. Nature.
7. Dysfunction.
8. Conjunctival.
9. Hasner.
10. Segment.

Short-answer questions

11. Obstruction and granulomatous inflammation of a meibomian gland, presenting as a firm, painless nodule.
12. Eyelid margin crusting, redness, irritation, and associated dry eye symptoms.
13. External hordeolum affects glands of Zeis/Moll and points toward the skin; internal hordeolum affects a meibomian gland and points toward the conjunctiva.
14. Chalazion is a chronic, sterile granulomatous process; hordeolum is an acute, infective process.
15. Infection of the lacrimal sac, presenting with pain, erythema, and swelling over the medial canthal region, often with mucopurulent discharge on pressure.

Long-answer questions

16. **Basic response:** A chalazion is a chronic, sterile granulomatous reaction to obstructed meibomian secretion, presenting as a firm, generally painless nodule.

Value-added response: Its chronic nature distinguishes it from the acute, painful, infective presentation of hordeolum, though secondary infection can occasionally complicate it.

17. **Basic response:** Blepharitis is classified as anterior, involving lashes and associated glands, or posterior, involving meibomian gland dysfunction.



Value-added response: Management centres on eyelid hygiene, with topical or oral antibiotics for more significant or chronic cases, given its relapsing-remitting natural history.

18. **Basic response:** External hordeolum affects the glands of Zeis or Moll, pointing toward the skin; internal hordeolum affects a meibomian gland, pointing toward the conjunctiva.

Value-added response: Both are acute, infective processes, distinguishing them from the chronic, sterile nature of chalazion, with direct implications for management approach.

19. **Basic response:** Nasolacrimal duct obstruction in infants results from incomplete canalisation, most commonly at the valve of Hasner, while adults typically develop involutional narrowing or post-infective/traumatic obstruction.

Value-added response: The characteristic feature is epiphora, with chronic obstruction predisposing to dacryocystitis.

20. **Basic response:** Infant obstruction generally begins with conservative lacrimal sac massage, given the likelihood of spontaneous resolution.

Value-added response: Persistent or adult obstruction generally requires probing and irrigation, or, for refractory cases, dacryocystorhinostomy.

Answers to Pilot Questions [Series 4]

Part 4.1

11. Obstruction and granulomatous inflammation of a meibomian gland; presents as a firm, generally painless tarsal plate nodule.
12. Because it is a chronic, sterile, granulomatous process rather than an acute infective one.
13. Anterior blepharitis involves lash follicles and glands of Zeis/Moll; posterior involves meibomian gland dysfunction.
14. Eyelid margin crusting, redness, irritation, and associated dry eye symptoms.
15. Eyelid hygiene with warm compresses and lid cleaning, plus topical or oral antibiotics for significant or chronic cases.

Part 4.2

1. Acute bacterial infection of glands of Zeis or Moll; *Staphylococcus aureus* is the typical causative organism.



2. A painful, erythematous, localised swelling at the eyelid margin, generally pointing toward the skin.
3. Acute infection of a meibomian gland; unlike external hordeolum, it points toward the conjunctival surface.
4. Chalazion is chronic and sterile; hordeolum is acute and infective.
5. Acute hordeolum generally responds to compresses/antibiotics; chronic chalazion may require surgical incision and curettage.

Part 4.3

6. Incomplete canalisation at birth, most commonly at the valve of Hasner.
7. Involutional age-related narrowing, prior infection, trauma, or, less commonly, tumour obstruction.
8. Excessive tearing; it results from impaired tear outflow despite normal tear production, a hallmark of obstruction.
9. Infection of the lacrimal sac; presents with pain, erythema, and swelling over the medial canthus, sometimes with mucopurulent discharge.
10. Conservative lacrimal sac massage first, followed by probing and irrigation, or dacryocystorhinostomy for refractory or adult cases.

References and Attributions [Series 4]

11. Kanski, J. J., & Bowling, B. (2015). Clinical Ophthalmology: A Systematic Approach (8th ed.). Elsevier.
12. Khurana, A. K. (2019). Comprehensive Ophthalmology (7th ed.). Jaypee Brothers Medical Publishers.
13. Riordan-Eva, P., & Augsburger, J. J. (Eds.). (2017). Vaughan and Asbury's General Ophthalmology (19th ed.). McGraw-Hill.
14. Collin, J. R. O. (2006). A Manual of Systematic Eyelid Surgery (3rd ed.). Elsevier.

Figures, Plates, Tables, and Boxes

1. Figure 4.1: Diagram comparing the appearance of a firm, painless chalazion nodule with the crusting and redness of blepharitis along the eyelid margin. AI-generated using the prompt: "A single clean, clinically accurate two-panel illustration of an eyelid, one panel labelled chalazion showing a smooth, firm nodule beneath the skin, the other panel



labelled blepharitis showing crusting and redness along the lash line, medical textbook diagram style, neutral background, no photographic realism, no other panels."

2. Table 4.2: Comparing chalazion, external hordeolum, and internal hordeolum. AI-generated using the prompt: "Create a clean clinical reference table titled Comparing Chalazion, External Hordeolum, and Internal Hordeolum, listing condition, nature, and typical presentation. Ophthalmology reference table style with outside border, no photographic elements."
3. Table 4.3: Comparing infant and adult nasolacrimal duct obstruction. AI-generated using the prompt: "Create a clean clinical reference table titled Comparing Infant and Adult Nasolacrimal Duct Obstruction, listing feature, infant obstruction, and adult obstruction. Ophthalmology reference table style with outside border, no photographic elements."



Course code: OPT 603

Course title: Cornea, External Eye Diseases, Lacrimal System, Orbit

Course credit load: 1 Unit

Series 5: Orbital Disease and Clinical Assessment of the Cornea, Proptosis, and Eyelid Position

- **Part 5.1: Orbital Cellulitis**
 - Sub Part 5.1.1: Preseptal versus orbital cellulitis
 - Sub Part 5.1.2: Clinical features and danger signs of orbital cellulitis
 - Sub Part 5.1.3: Management of orbital cellulitis
- **Part 5.2: Graves Ophthalmopathy**
 - Sub Part 5.2.1: Pathophysiology of Graves ophthalmopathy
 - Sub Part 5.2.2: Clinical features of Graves ophthalmopathy
 - Sub Part 5.2.3: Assessing proptosis by inspection
- **Part 5.3: Clinical Assessment of the Cornea and Eyelid Position**
 - Sub Part 5.3.1: Assessing corneal clarity with a pen torch
 - Sub Part 5.3.2: Measuring upper eyelid position using margin reflex distance
 - Sub Part 5.3.3: Integrating external eye assessment into clinical practice

Introduction

In the last Series, we established inflammatory and infective eyelid disease and nasolacrimal duct obstruction. We now conclude this course with two important **orbital diseases**, orbital cellulitis and Graves ophthalmopathy, together with the essential practical **clinical assessment skills** of examining corneal clarity, recognising proptosis, and measuring upper eyelid position, integrating the anatomical and clinical foundation established throughout this course into confident bedside practice.

The aim of this Series is to equip you with a thorough understanding of orbital diseases, including orbital cellulitis and Graves ophthalmopathy, assessing corneal clarity with a pen



torch, assessing the presence of proptosis by inspection, and assessing upper eyelid position by measuring the distance between the lid margin and the corneal reflex.

This Series begins with **orbital cellulitis**, before examining **Graves ophthalmopathy**. It concludes with **clinical assessment of the cornea and eyelid position**.

Series Learning Outcomes

At the end of this Series, you should be able to:

- **SLO 5.1:** distinguish preseptal from orbital cellulitis and describe its clinical features and danger signs
- **SLO 5.2:** describe the management of orbital cellulitis
- **SLO 5.3:** describe the pathophysiology and clinical features of Graves ophthalmopathy
- **SLO 5.4:** assess the presence of proptosis by inspection
- **SLO 5.5:** assess corneal clarity using a pen torch, and
- **SLO 5.6:** measure upper eyelid position by assessing the distance between the lid margin and the corneal reflex.

5.1 Orbital Cellulitis

5.1.1 preseptal versus orbital cellulitis

A distinction defined by the orbital septum

Preseptal cellulitis refers to infection confined anterior to the **orbital septum**, discussed in relation to orbital septum anatomy in an earlier Series of this course, generally presenting with eyelid swelling and redness without significant involvement of deeper orbital structures.

Orbital cellulitis, by contrast, refers to infection extending posterior to the orbital septum, discussed earlier in this Part, involving the orbital fat and extraocular muscles, discussed in relation to orbital anatomy in an earlier Series of this course, representing a genuinely more serious condition given the proximity of these deeper orbital **structures** to the globe, optic nerve, and, potentially, intracranial structures.



Fill in the blank: Orbital cellulitis refers to infection extending posterior to the orbital septum, representing a genuinely more serious condition given the proximity of these deeper orbital structures to the globe, optic nerve, and, potentially, intracranial _____.

5.1.2 clinical features and danger signs of orbital cellulitis

Clinical features distinguishing orbital cellulitis from preseptal cellulitis, discussed earlier in this Part, include **proptosis**, discussed further later in this Series, restricted or painful ocular motility, discussed in relation to extraocular muscle examination in an earlier related course, and reduced **visual acuity**, discussed in an earlier related course.

Further important danger signs include a **relative afferent pupillary defect**, discussed in relation to pupillary examination in an earlier related course, and significant, disproportionate pain, particularly on eye movement, together indicating genuine optic nerve compromise or extensive orbital involvement requiring urgent **intervention**.

Fill in the blank: Further important danger signs of orbital cellulitis include a relative afferent pupillary defect and significant, disproportionate pain, particularly on eye movement, indicating genuine optic nerve compromise requiring urgent _____.

5.1.3 management of orbital cellulitis

Orbital cellulitis represents a genuine ophthalmic emergency, discussed throughout this Part, generally requiring **admission** for intravenous antibiotic therapy, discussed in relation to infection management principles throughout this course, and close, ongoing monitoring of visual acuity and pupillary function, discussed earlier in this Part, for signs of deterioration.

Imaging, generally CT of the orbit and sinuses, discussed in relation to CT principles in an earlier related course, is frequently indicated to assess for orbital abscess formation or intracranial extension, with surgical drainage indicated where a significant abscess is identified or where the patient fails to respond adequately to antibiotic therapy **alone**.

Fill in the blank: Imaging, generally CT of the orbit and sinuses, is frequently indicated to assess for orbital abscess formation or intracranial _____.

Table 5.1: Comparing preseptal and orbital cellulitis.

Feature	Preseptal cellulitis	Orbital cellulitis
Anatomical extent	Confined anterior to the orbital septum	Extends posterior to the orbital septum



Proptosis or restricted motility	Absent	Present
Management	Generally oral antibiotics	Urgent admission and intravenous antibiotics

Pilot questions 5.1

- Distinguish preseptal from orbital cellulitis. (Linked to SLO 5.1)
- List the clinical features distinguishing orbital cellulitis from preseptal cellulitis. (Linked to SLO 5.1)
- List further danger signs of orbital cellulitis. (Linked to SLO 5.1)
- Describe the management of orbital cellulitis. (Linked to SLO 5.2)
- Explain the role of CT imaging in orbital cellulitis. (Linked to SLO 5.2)

5.2 Graves Ophthalmopathy

5.2.1 pathophysiology of graves ophthalmopathy

An autoimmune process affecting orbital tissue

Graves ophthalmopathy, an autoimmune condition generally associated with Graves disease and hyperthyroidism, results from immune-mediated inflammation and subsequent **fibrosis** of the extraocular muscles, discussed in relation to extraocular muscle anatomy in an earlier related course, and orbital fat, producing characteristic tissue **expansion** within the fixed volume of the bony orbit.

This orbital tissue expansion, discussed earlier in this Part, produces forward displacement of the globe, discussed further in the next sub-Part, together with eyelid retraction, discussed in relation to eyelid malposition in an earlier Series of this course, reflecting the specific pattern of tissue involvement characteristic of this **condition**.

Fill in the blank: Graves ophthalmopathy results from immune-mediated inflammation and subsequent fibrosis of the extraocular muscles and orbital fat, producing characteristic tissue expansion within the fixed volume of the bony _____.

5.2.2 clinical features of graves ophthalmopathy

Clinical features of Graves ophthalmopathy include **proptosis**, discussed further in the next sub-Part, **eyelid retraction**, discussed earlier in this Series, and **restricted ocular motility**, discussed



in relation to extraocular muscle examination in an earlier related course, resulting from fibrotic muscle involvement.

Further important clinical features include **exposure keratopathy**, discussed in relation to eyelid malposition complications earlier in this Series, resulting from the combination of proptosis and lid retraction, and, in severe cases, **optic nerve compression** from crowding of the orbital apex by enlarged extraocular muscles, threatening genuine visual **loss**.

Fill in the blank: In severe cases of Graves ophthalmopathy, optic nerve compression from crowding of the orbital apex by enlarged extraocular muscles can threaten genuine visual _____.

5.2.3 assessing proptosis by inspection

Proptosis, discussed throughout this Part, abnormal forward protrusion of the globe, is initially assessed by careful inspection, generally observing the patient from above and behind while they look downward, allowing the examiner to compare the relative degree of corneal **protrusion** beyond the plane of the superior orbital rim on each side.

This inspection technique, discussed earlier in this Part, allows detection of even relatively **asymmetric** proptosis that might otherwise be difficult to appreciate from a direct frontal viewing angle, with more precise, objective measurement generally requiring a specific instrument, an **exophthalmometer**, for formal quantification where indicated.

Fill in the blank: Careful inspection of proptosis, observing the patient from above and behind while they look downward, allows detection of even relatively asymmetric protrusion beyond the plane of the superior orbital _____.



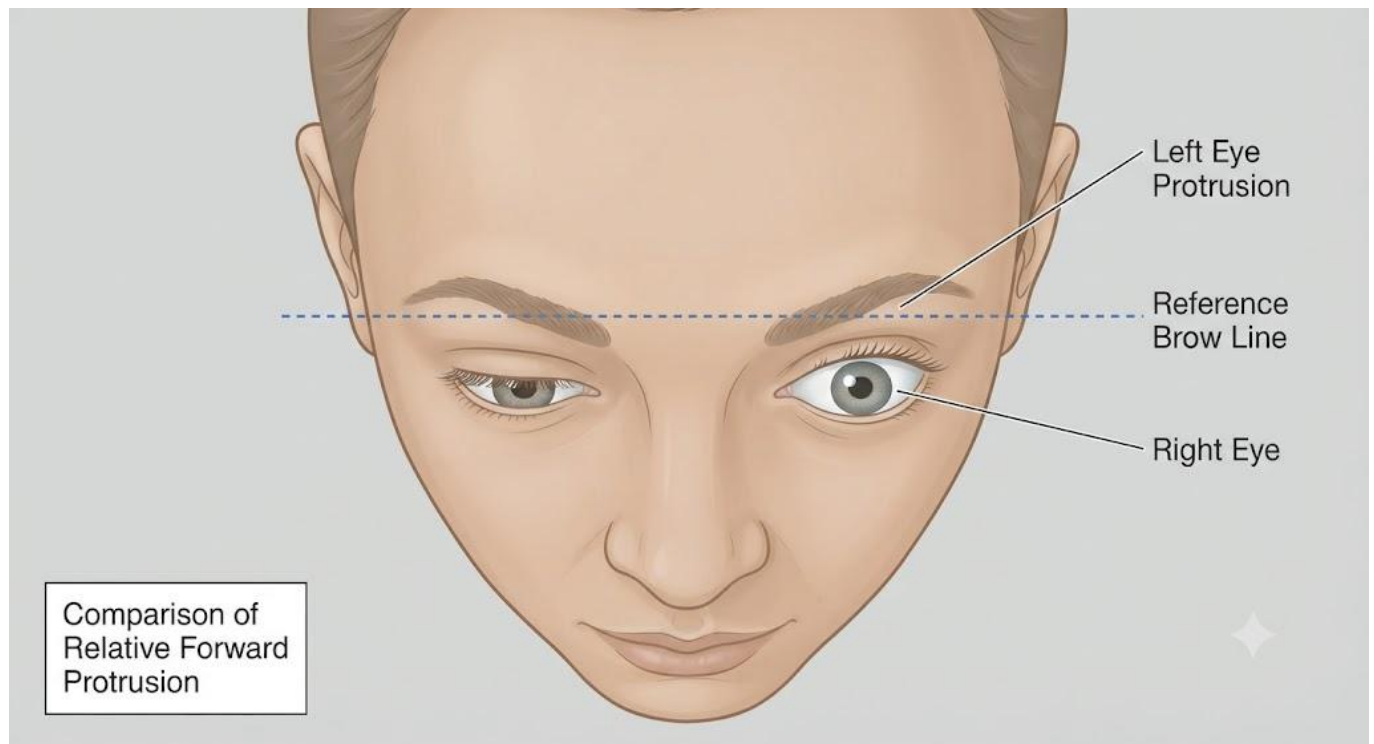


Figure 5.2: Diagram illustrating the technique for assessing proptosis by observing the patient from above and behind while comparing corneal protrusion on each side.

Pilot questions 5.2

1. Describe the pathophysiology of Graves ophthalmopathy. (Linked to SLO 5.3)
2. List the clinical features of Graves ophthalmopathy. (Linked to SLO 5.3)
3. Explain how optic nerve compression can occur in severe Graves ophthalmopathy. (Linked to SLO 5.3)
4. Describe the technique for assessing proptosis by inspection. (Linked to SLO 5.4)
5. Explain the purpose of an exophthalmometer. (Linked to SLO 5.4)

5.3 Clinical Assessment of the Cornea and Eyelid Position

5.3.1 assessing corneal clarity with a pen torch

A simple, accessible technique for detecting corneal opacity

Assessment of **corneal clarity** using a pen torch, discussed in relation to corneal transparency in an earlier Series of this course, involves directing focused illumination obliquely across the



corneal surface, allowing detection of subtle opacity, discussed in relation to endothelial function earlier in this course, that might otherwise be missed under diffuse ambient lighting.

This simple, widely accessible technique allows recognition of corneal **haze**, scarring, or foreign material, discussed in relation to ocular trauma in an earlier related course, providing valuable diagnostic information even in clinical settings lacking access to more specialised slit lamp **examination** equipment.

Fill in the blank: Assessment of corneal clarity using a pen torch involves directing focused illumination obliquely across the corneal surface, allowing detection of subtle opacity that might otherwise be missed under diffuse ambient _____.

5.3.2 measuring upper eyelid position using margin reflex distance

Margin reflex distance, discussed in relation to ptosis assessment in an earlier Series of this course, is measured by directing a pen torch light source at the patient's eyes and measuring the distance between the **upper eyelid margin** and the resulting corneal light reflex, generally with the patient looking directly at the light source.

This measurement, discussed earlier in this Part, provides an objective, reproducible assessment of upper eyelid position, relevant both to detecting **ptosis**, discussed earlier in this Series, and to detecting eyelid **retraction**, discussed earlier in this Series, since abnormal measurement in either direction carries specific diagnostic **significance**.

Fill in the blank: Margin reflex distance provides an objective, reproducible assessment of upper eyelid position, relevant both to detecting ptosis and to detecting eyelid _____.

5.3.3 integrating external eye assessment into clinical practice

The practical assessment techniques discussed throughout this Series, corneal clarity evaluation, proptosis inspection, and margin reflex distance measurement, together form an essential, efficient component of routine **external eye examination**, complementing the history taking and systematic examination principles established throughout this course.

Confident, consistent application of these techniques, discussed throughout this Series, supports early recognition of the range of external eye and orbital conditions examined throughout this course, from eyelid malposition through inflammatory and infective disease to genuine orbital **emergencies**, reflecting the genuinely integrated nature of comprehensive external eye assessment.



Fill in the blank: Confident, consistent application of external eye assessment techniques supports early recognition of the range of conditions examined throughout this course, from eyelid malposition to genuine orbital _____.

Table 5.3: Key external eye assessment techniques and their purpose.

Technique	What it assesses	Clinical relevance
Pen torch corneal examination	Corneal clarity, opacity, and foreign material	Detects corneal disease and trauma
Proptosis inspection	Relative forward globe protrusion	Detects orbital disease such as Graves ophthalmopathy
Margin reflex distance	Upper eyelid position relative to the corneal reflex	Detects ptosis and eyelid retraction

Pilot questions 5.3

1. Describe the technique for assessing corneal clarity with a pen torch. (Linked to SLO 5.5)
2. Explain why pen torch corneal assessment remains valuable in settings without slit lamp access. (Linked to SLO 5.5)
3. Describe how margin reflex distance is measured. (Linked to SLO 5.6)
4. Explain the diagnostic relevance of margin reflex distance to both ptosis and eyelid retraction. (Linked to SLO 5.6)
5. Describe how the assessment techniques discussed in this Series integrate into routine external eye examination. (Linked to SLO 5.6)

Series Summary

This final Series examined **orbital disease and clinical assessment of the cornea, proptosis, and eyelid position**, beginning with **orbital cellulitis**, its distinction from preseptal cellulitis, clinical features, danger signs, and management, before examining **Graves ophthalmopathy**, its pathophysiology, clinical features, and the technique for assessing proptosis by inspection.

We concluded with **clinical assessment of the cornea and eyelid position**, assessing corneal clarity with a pen torch, measuring margin reflex distance, and integrating these techniques into routine external eye examination. Having worked through this Series, and indeed this entire



course, you should now possess a comprehensive introductory foundation in the cornea, external eye diseases, lacrimal system, and orbit, from anatomy through tear physiology and the red eye, eyelid malpositions, inflammatory and infective eyelid disease, and, finally, orbital disease and clinical assessment technique addressed throughout OPT 603.

Glossary of Terms

1. **Preseptal cellulitis:** infection confined anterior to the orbital septum.
2. **Orbital cellulitis:** infection extending posterior to the orbital septum, a genuine ophthalmic emergency.
3. **Proptosis:** abnormal forward protrusion of the globe.
4. **Graves ophthalmopathy:** an autoimmune orbital condition associated with Graves disease, causing tissue expansion within the orbit.
5. **Exophthalmometer:** an instrument used for objective, quantified measurement of proptosis.
6. **Optic nerve compression (orbital):** compression of the optic nerve from crowding at the orbital apex, threatening vision.
7. **Corneal haze:** reduced corneal transparency detectable on careful pen torch examination.
8. **Margin reflex distance:** the distance between the upper eyelid margin and the corneal light reflex.
9. **Exposure keratopathy:** corneal epithelial damage from inadequate corneal coverage, a risk in Graves ophthalmopathy.
10. **External eye examination:** the integrated bedside assessment of the eyelids, cornea, and orbit.
11. **Orbital apex:** the posterior region of the orbit where the optic nerve and extraocular muscles converge.
12. **Relative afferent pupillary defect:** an objective sign of significant unilateral optic nerve or retinal pathology, relevant as a danger sign in orbital cellulitis.

Concept Check Questions [Series 5]

Objective questions

1. Orbital cellulitis refers to infection extending posterior to the orbital septum, representing a genuinely more serious condition given the proximity of these deeper orbital structures to the globe, optic nerve, and, potentially, intracranial _____.



2. Graves ophthalmopathy results from immune-mediated inflammation and subsequent fibrosis of the extraocular muscles and orbital fat, producing characteristic tissue expansion within the fixed volume of the bony _____.
3. Careful inspection of proptosis allows detection of even relatively asymmetric protrusion beyond the plane of the superior orbital _____.
4. Assessment of corneal clarity using a pen torch allows detection of subtle opacity that might otherwise be missed under diffuse ambient _____.
5. Margin reflex distance provides an objective, reproducible assessment of upper eyelid position, relevant both to detecting ptosis and to detecting eyelid _____.

Short-answer questions

- Distinguish preseptal from orbital cellulitis.
- List the danger signs of orbital cellulitis.
- List the clinical features of Graves ophthalmopathy.
- Describe the technique for assessing proptosis by inspection.
- Describe how margin reflex distance is measured.

Long-answer questions

1. Discuss the distinction between preseptal and orbital cellulitis, clinical features, danger signs, and management. (Linked to SLO 5.1, SLO 5.2)
2. Discuss the pathophysiology and clinical features of Graves ophthalmopathy. (Linked to SLO 5.3)
3. Discuss the technique for assessing proptosis by inspection. (Linked to SLO 5.4)
4. Discuss assessing corneal clarity with a pen torch. (Linked to SLO 5.5)
5. Discuss measuring upper eyelid position using margin reflex distance and integrating external eye assessment into clinical practice. (Linked to SLO 5.6)

Answers to Concept Check Questions [Series 5]

Objective questions

6. Structures.
7. Orbit.
8. Rim.
9. Lighting.
10. Retraction.



Short-answer questions

11. Preseptal cellulitis is confined anterior to the orbital septum; orbital cellulitis extends posterior to it, involving deeper structures.
12. Proptosis, restricted or painful ocular motility, reduced visual acuity, relative afferent pupillary defect, and disproportionate pain.
13. Proptosis, eyelid retraction, restricted ocular motility, exposure keratopathy, and, in severe cases, optic nerve compression.
14. Observing the patient from above and behind while they look downward, comparing corneal protrusion on each side.
15. Directing a pen torch at the eyes and measuring the distance between the upper eyelid margin and the resulting corneal light reflex.

Long-answer questions

16. **Basic response:** Preseptal cellulitis is confined anterior to the orbital septum, while orbital cellulitis extends posteriorly, involving deeper structures with genuine emergency implications.

Value-added response: Danger signs including proptosis, restricted motility, reduced acuity, and RAPD warrant urgent admission, imaging, and intravenous antibiotics.

17. **Basic response:** Graves ophthalmopathy results from autoimmune fibrosis of extraocular muscles and orbital fat, producing tissue expansion within the fixed orbital volume.

Value-added response: This produces proptosis, lid retraction, restricted motility, exposure keratopathy, and, in severe cases, sight-threatening optic nerve compression.

18. **Basic response:** Proptosis is assessed by observing the patient from above and behind while looking down, comparing relative corneal protrusion on each side.

Value-added response: More precise, objective measurement uses an exophthalmometer where formal quantification is required.

19. **Basic response:** Corneal clarity is assessed using oblique pen torch illumination, detecting subtle opacity, scarring, or foreign material.

Value-added response: This accessible technique provides valuable diagnostic information even without specialised slit lamp equipment.

20. **Basic response:** Margin reflex distance measures the distance between the upper lid margin and the corneal light reflex, detecting both ptosis and retraction.



Value-added response: Together with corneal and proptosis assessment, this forms an integrated, efficient component of routine external eye examination.

Answers to Pilot Questions [Series 5]

Part 5.1

11. Preseptal cellulitis is confined anterior to the orbital septum; orbital cellulitis extends posterior to it, involving deeper structures.
12. Proptosis, restricted or painful ocular motility, and reduced visual acuity.
13. Relative afferent pupillary defect and significant, disproportionate pain, particularly on eye movement.
14. Urgent admission for intravenous antibiotics and close monitoring of visual acuity and pupillary function.
15. It assesses for orbital abscess formation or intracranial extension.

Part 5.2

1. Immune-mediated inflammation and fibrosis of extraocular muscles and orbital fat, producing tissue expansion within the fixed orbital volume.
2. Proptosis, eyelid retraction, restricted ocular motility, exposure keratopathy, and, in severe cases, optic nerve compression.
3. Crowding of the orbital apex by enlarged extraocular muscles can compress the optic nerve.
4. Observing the patient from above and behind while they look downward, comparing corneal protrusion beyond the superior orbital rim on each side.
5. It provides objective, quantified measurement of proptosis.

Part 5.3

6. Directing focused illumination obliquely across the corneal surface to detect subtle opacity.
7. Because it provides valuable diagnostic information even where more specialised equipment is unavailable.
8. Directing a pen torch light at the eyes and measuring the distance between the upper eyelid margin and the corneal light reflex.
9. Abnormal measurement in either direction, reduced or increased, carries specific diagnostic significance for ptosis or retraction respectively.



10. They together form an essential, efficient component of routine external eye examination, complementing history taking and systematic examination.

References and Attributions [Series 5]

11. Kanski, J. J., & Bowling, B. (2015). Clinical Ophthalmology: A Systematic Approach (8th ed.). Elsevier.
12. Riordan-Eva, P., & Augsburger, J. J. (Eds.). (2017). Vaughan and Asbury's General Ophthalmology (19th ed.). McGraw-Hill.
13. Khurana, A. K. (2019). Comprehensive Ophthalmology (7th ed.). Jaypee Brothers Medical Publishers.
14. Bahn, R. S. (2010). Graves' Ophthalmopathy. New England Journal of Medicine, 362(8), 726-738.

Figures, Plates, Tables, and Boxes

1. Table 5.1: Comparing preseptal and orbital cellulitis. AI-generated using the prompt: "Create a clean clinical reference table titled Comparing Preseptal and Orbital Cellulitis, listing feature, preseptal cellulitis, and orbital cellulitis. Ophthalmology reference table style with outside border, no photographic elements."
2. Figure 5.2: Diagram illustrating the technique for assessing proptosis by observing the patient from above and behind while comparing corneal protrusion on each side. AI-generated using the prompt: "A single clean, clinically accurate illustration showing an examiner's viewpoint looking down and slightly forward at a patient's face with eyes looking downward, comparing the relative forward protrusion of each eye beyond the brow line, medical textbook diagram style, neutral background, no photographic realism, no other panels."
3. Table 5.3: Key external eye assessment techniques and their purpose. AI-generated using the prompt: "Create a clean clinical reference table titled Key External Eye Assessment Techniques and Their Purpose, listing technique, what it assesses, and clinical relevance. Ophthalmology reference table style with outside border, no photographic elements."

