

Major Review

Complications of contact lens

ABSTRACT

Contact lens is valuable optical aid to vision in the presence of severe refractive error and treatment of certain chronic diseases. Complications can be prevented by precise fitting, regular follow-up, early recognition, and management of complications by an experienced ophthalmologist. The ocular complications range from harmless irritation to sight-threatening corneal ulceration.

Keywords: Contact lens complications, corneal warpage, microbial keratitis, papillary conjunctivitis, sterile corneal infiltrates

INTRODUCTION

Contact lens is valuable optical device used in the presence of severe refractive error and treatment of certain chronic diseases.^[1,2] It acts as a physical barrier to normal tear-cornea-lid mechanics and corneal metabolism which can lead to adverse reactions mainly due to oxygen deprivation.^[2] Contact lens can be used for many years without problems only if they are made of well-chosen material, correctly shaped, and properly fitted. The ocular complications range from harmless irritation to sight-threatening corneal ulceration and even loss of eye.^[1]

COMPLICATIONS OF CONTACT LENS WEAR

According to 2006 census, 125 million people were using contact lens worldwide.^[3,4] Severity and frequency of complications of contact lens vary greatly.^[5] Contact lens complications are related to three basic mechanisms:

1. Mechanical trauma to the conjunctiva and cornea
2. Acute and chronic hypoxia from decreased transmissibility of oxygen
3. Allergic reactions from protein deposits in the contact lenses.

Many patients have associated dry eyes or blepharitis, which further compromise the conjunctival and corneal surface, increasing the chances of complications. With advances in

manufacturing techniques, advances in lens materials, and improved hygienic measures, frequency of complications has decreased.^[6]

CORNEAL COMPLICATIONS

Corneal staining

Corneal staining is probably the most familiar of all potential contact lens complications. The prevalence is as high as 60% and is generally clinically insignificant.^[7]

Epithelial microcysts

Epithelial microcysts are an important indicator of chronic metabolic stress and can be readily observed with the slit-lamp biomicroscope. It is usually seen in the central and paracentral cornea. They appear as minute scattered gray opaque dots with focal illumination and as transparent refractile inclusions with indirect retroillumination. Visual acuity is generally unaffected by microcysts. They are usually seen with soft contact lens, especially with extended wear lens. The presence of a small number of microcysts is not dangerous, but a large number of microcysts represent

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epithelial metabolic distress. It can be treated by decreasing the frequency of overnight wear, changing to daily wear, or increasing the frequency of lens replacement.^[6]

Epithelial edema

A small number of vacuoles and bullae can be seen in the corneas of contact lens wearers. They are clinically innocuous but can be confused with other small epithelial inclusions which are clinically more serious. It is the most common and earliest corneal change due to hypoxia.^[6]

On slit-lamp biomicroscopy, vacuoles appear as spherical bodies located within the corneal epithelium with perfectly rounded and distinct edges. They are innocuous and are not apparently associated with any adverse symptom.^[8]

Stromal edema

The prevalence of contact lens-induced edema is essentially 100%. The amount of edema is related primarily to the extent of corneal hypoxia that is induced by the lens.^[6] Low Dk hydrogel and rigid lenses induce a daytime central corneal edema between 1% and 6% and overnight central edema in the range 10%–15%.^[9] Silicone hydrogel lenses induce <3% overnight central corneal edema,^[10] which is similar to the level of overnight edema without lenses. The structural changes seen are striae, folds, and haze, and they correlate with various levels of edema. It can be graded from 0 to grade.^[4] The most common etiology is hypoxia.^[11] Treatment of stromal oedema include 1) change of lens type from extended wear to daily wear lenses or soft to rigid lenses, 2) reduce wearing time, 3) anti-inflammatory drugs. In general, the prognosis for recovery of the cornea from lens-induced edema is excellent.^[6]

Microbial keratitis

Microbial keratitis is defined as an inflammation of corneal tissue due to direct infection by microbial agents such as bacteria, fungi, protozoa, and viruses. It is the most dangerous complication occurs in response to contact lens wear which can be potentially devastating to the cornea [Figure 1]. Predisposing factors include poor personal hygiene, inadequate lens disinfection, contaminated lens solution or lens case, and associated external diseases. *Pseudomonas aeruginosa* and *Acanthamoeba* are the most common organisms involved in lens-related keratitis.^[6] Bacterial keratitis should be suspected in patients with continuing or worsening discomfort following lens removal. Other symptoms include pain, eye redness, increased lacrimation, photophobia, discharge, and decreased vision.^[6]

The specific bacterium implicated in majority of cases of bacterial keratitis is *P. aeruginosa*. Other Gram-negative

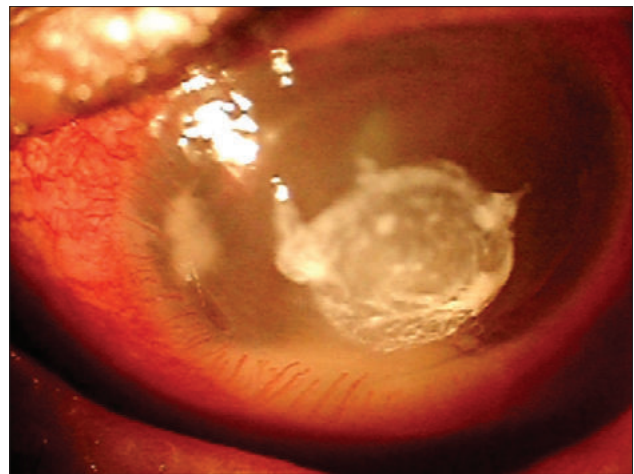


Figure 1: Keratitis

bacterial species causing keratitis include *Serratia*, *Enterobacter*, *Escherichia coli*, and *Klebsiella*. Less frequently Gram-positive bacteria such as *Staphylococcus aureus* and *Staphylococcus epidermidis* may cause bacterial keratitis. The major risk factor of infective keratitis is overnight lens wear. Any patient presenting with a combination of (a) contact lens wear, (b) ocular discomfort, and (c) presence of corneal infiltrates should be assumed to be a potential microbial keratitis and should be managed accordingly until proven otherwise.^[6]

Treatment depends on etiological agent. The prognosis for recovery is variable and depends largely on the speed and efficacy of treatment.^[6] Prevention, early diagnosis, and appropriate treatment of contact lens-related infections are very important.^[5]

Epithelial wrinkling

Epithelial wrinkling is a severe ocular complication of contact lens wear and is characterized by the appearance of a series of deep parallel grooves in the corneal surface giving the impression of a “wrinkled” effect.^[12] The treatment protocol is to stop lens wear and reassure patients. The prognosis for recovery following epithelial wrinkling is good.^[6]

Corneal warpage

“Corneal warpage” is term used for contact lens-induced shape change resulting in astigmatism.^[6] Finnemore and Korb^[13] reported that 98% of Polymethyl methacrylate (PMMA) lens wearers develop some degree of corneal steepening and 30% of warpage reported by Rengstorff.^[14] Current generation rigid lenses of low-to-medium oxygen transmissibility (Dk/t) induce little or no change in overall corneal shape and also by daily wear or extended wear hydrogel lenses.^[15,16] All forms of contact lens wear are capable of inducing small, statistically significant changes in corneal topography. The clinical presentation of lens-induced corneal shape change will depend primarily upon

the material, design, and fit of the lens. In general, adverse signs and symptoms of corneal shape change include reduced and variable vision, changes in refraction, and monocular diplopia.^[6]

Contact lens wear should be discontinued when suspecting corneal warpage until refraction and topography stabilize. It may take weeks for recovery. After stabilizing refraction, refitting of contact lens can be done with different types of lens under close monitoring of patient.^[5]

Sterile corneal infiltrates

These are infiltration of leukocytes as result of inflammatory response to specific antigen, especially due to preservatives in lens solutions. They appear as small asymptomatic peripheral opacities. It is associated with mild pain and disappears on discontinuation of contact lens. It is not associated with anterior chamber reaction and surrounding corneal edema which helps to differentiate from infectious keratitis.^[5]

Endothelial changes

Endothelial bleb, endothelial bedewing, polymegathism, and pleomorphism are the endothelial changes seen in contact lens wearers. These are thought to be due to series of events following hypoxia. Contact lens-associated endothelial bedewing is seen as small inclusions in the region of the inferior central cornea near to or immediately below the inferior pupil margin. They appear at the level of the endothelium and are bilateral. These can be reduced by the use of daily wear lens and rigid gas permeable lens.^[6]

Other corneal changes following contact lens use include superficial punctate keratitis, corneal abrasions, and corneal neovascularization.^[6]

CONJUNCTIVAL COMPLICATIONS

Conjunctival staining

Well-fitted rigid lenses generally reside almost exclusively on the cornea and only occasionally impinge upon the limbus. However, the soft contact lens produces changes in the conjunctiva due to its physical apposition.^[6] Thick rigid lenses can “bridge” the upper lid away from the conjunctiva, preventing blink-activated wetting, and causing drying. Contact lens solutions can cause toxic or immunologic reactions of the conjunctiva. Lens-induced changes in the volume and composition of the precorneal tear film may also indirectly lead to changes in the conjunctiva. Vital dyes such as fluorescein sodium can be used to assess the damage.^[17]

Papillary conjunctivitis

The term “giant papillary conjunctivitis” was coined by Allansmith^[18] to describe papillary changes occur on the

tarsal conjunctiva that were like a cobblestone formation. The appearance of the lesions depends on the level of severity and type of lens wear. “Contact lens-induced papillary conjunctivitis” (CLPC) may develop 3 weeks–4 years following soft lens. In rigid lens wearers, CLPC typically appears after about 14 months.^[6]

It is important that an assessment is made only of the central region of the tarsal plate. An important early distinguishing feature of CLPC is increased redness of the tarsal conjunctiva which can be detected with reference to the lower palpebral conjunctiva. Lower palpebral conjunctiva is usually unaffected and can act as a “baseline” against which any change is measured. In advanced cases, papillae can exceed 1 mm in size with a bright red/orange hue. Other signs include conjunctival edema and excessive mucus which usually forms into strands lying in the valleys between papillae. According to Allansmith, CLPC was different in soft versus rigid lens wearers. In soft lens wearers, papillae are more numerous, located more toward the upper tarsal plate, and the apex of the papillae takes on a rounded flatter form. In rigid lens wearers, papillae are crater-like and are located more toward the lash margin, with few papillae being present on the upper tarsal plate. Patients may complain of itching, discomfort, and increase in mucus production.^[6]

In the early stages of CLPC, patients may complain of discomfort and slight itching, increase in mucus production upon awakening, and intermittent blurring. In more severe cases, the patient is forced to remove the contact lens because of severe itching and discomfort. Excessive lens movement and decentration can occur due to large papillae and excess mucus.^[6]

A number of factors have been suggested in the etiology of CLPC which include mechanical trauma, immediate and delayed hypersensitivity, individual susceptibility such as atopy, and meibomian gland dysfunction.^[6]

Treatments include (a) alterations of the type, design, and modality of lens wear; (b) alterations to care systems; (c) improving ocular hygiene; and (d) prescribing pharmaceutical agents. Two percent or 4% cromolyn sodium four times a day, histamine H₁ receptor agonists, such as olopatadine, ketotifen, azelastine, and epinastine, and steroidal agents can be very effective in severe cases of CLPC, oral antihistamines, and topical vasoconstrictor agents.^[6]

The prognosis for recovery after removal of contact lenses and cessation of wear is good. Even in the most severe cases, symptoms will disappear within 5 days–2 weeks of lens removal. Resolution of papillae takes place over a much longer time course – typically many weeks and as long as 6 months.^[6]

Superior limbic keratoconjunctivitis

Because of the strong association between contact lens-induced superior limbic keratoconjunctivitis (CLSLK) and the use of contact lens care solutions containing thimerosal, this condition has also been called “thimerosal keratoconjunctivitis” or “thimerosal keratopathy.” Symptoms of CLSLK include increased lens awareness, lens intolerance, foreign body sensation, burning, itching, photophobia, redness, increased lacrimation, and mucus discharge.^[6]

A myriad of signs occur in patients with CLSLK, which include punctate epithelial fluorescein staining typically in the upper third to half of the cornea, epithelial rose bengal staining, intraepithelial opacities, subepithelial haze extending in a V-shaped pattern toward the pupil, epithelial dulling, epithelial microcysts, epithelial infiltrates, epithelial irregularity of the superior cornea, stromal opacification, and fibrovascular micropannus. The condition is always bilateral and the accumulated clinical evidence implicating thimerosal as the prime cause of CLSLK provides an excellent focus for treating this condition.^[6] CLSLK can be mistaken for infiltrative keratitis. A culture-positive scraping will help in diagnosis of an infectious keratitis. Suspect true CLSLK if thimerosal-preserved care solutions are used.^[6]

Patients suffering from CLSLK may be advised to cease lens wear for few weeks to months, elimination of thimerosal, or alteration to the lens.^[6]

CONCLUSION

Contact lenses are generally safe and worn by millions of people without complications. The complications due to contact lens wear vary greatly. Proper history and regular follow-up will help in early diagnosis and treatment of complications. Every ocular examination is an opportunity for educating patients to reduce complications.^[5]

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Conflicts of interest

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