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General Medical Information

Contact Lens

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Introduction

Many persons who need eyeglasses to improve their vision choose to wear contact lenses. Contact lenses and regular eyeglasses have many things in common. The lenses of both are constructed to improve the patient's vision and do this primarily by focusing images on the retina of the eye.

Contact lenses allow a greater field of vision because they become part of the optical system of the eye and move with the eye. They change position as a person rolls his eyes. This means that he is always looking through the center of the lens, and his vision is not distorted. Because spectacle lenses are rigidly fixed in place and do not move with the eye, a person often must look through the outer edges of lens area, which usually causes a distorted view. Contact lenses do not fog up with moisture, and they have no heavy frames. Many athletes find them preferable to regular eyeglasses for these reasons.

Almost anyone who wishes to wear contact lenses can do so. Many persons find that the initial adjustment period may involve discomfort and adaptation but that after a short period of time, vision, as well as the lenses, is comfortable.

To be fitted for contact lenses, you should have your eyes examined by an ophthalmologist or optometrist, who will prepare the correct prescription for you. When your lenses arrive from the laboratory, they are checked against the original prescription to make sure that they will give you the desired correction of vision. Then they must be fitted to your eyes to assure you comfort and all-day wearing time.

The contact lenses float on a thin layer of tears on the surface of the eye. Special solutions for storage of the lenses when not in use also have antiseptic qualities to prevent any contamination of the eye.

Lenses should be handled carefully at all times. If the surface is scratched or the edges nicked even slightly, discomfort and reduction of wearing time, even eye damage, may result.

Because a contact lens fits directly on the surface of the eye, it can do some things that a spectacle lens can not do, including providing a tough plastic shield over the area it covers. Sometimes a contact lens is used to reshape the eye in cases of irregularities. Keratoconus, a non-inflammatory disease that results in a conical reshaping of the cornea, can often be controlled with contact lenses. The contact lens actually presses the eye back into its proper shape. In such cases, contact lenses restore eyesight to people who cannot be helped by any other optical means.

Contact lenses are available in different colors which can be used to enhance the color of your own eyes. There are also cosmetic contact lenses available to change the color of your eyes completely. Bifocal contact lenses can be prepared when necessary.

Forms of Contact Lenses

Hard lenses: Hard lenses are made from plastic non-toxic material called polymethylmethacrylate (PMMA) or Perspex. This substance has reproducible physical properties, which enable it to be fenestrated and moulded into any size or shape to give good optical and cosmetic results.

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Forms of Contact Lenses

Hard lenses are of three types:

1. *Corned* lenses with a diameter of between 8.5 and 10 mm.
2. *Scleral* (haptic) lenses which override the cornea and rest on the sclera. Their use is now limited to certain specific conditions such as advanced keratoconus or severe lid disorders.
3. *Hybrid* lenses which are the same diameter as the cornea. These are used mainly as cosmetic lenses to hide an unsightly eye.

Advantages

Because hard lenses are very durable they are particularly suitable for children who might handle a contact lens more roughly than an adult.

Disadvantages

These lenses are only suitable for daily wear. This is because oxygen does not permeate PMMA so that the cornea depends on the tear pump to obtain its oxygen. If the lens is worn for too long or during sleep, corneal hypoxia may cause blurring of vision due to epithelial oedema. In order to supplement the tear pump, the PMMA lens must be made small and steep. Although this allows more oxygen to reach the cornea, it results in a small optic zone. This may give rise to annoying glare at night from oncoming headlights when the pupil becomes as large as the optic zone of the lens and light enters the pupil around the optic zone.

- ***Gas permeable:*** These are made from a mixture of a hard and a soft material. They may be adjusted and polished, similar to PMMA lenses, and are treated in the same way, with regard to handling and aftercare. They are often used in patients who are unable to wear soft lenses owing to allergies or other associated pathology. Because they are usually more comfortable than hard PMMA lenses, they are a good choice for more sensitive eyes.

  Advantages

  Since these lenses are permeable to oxygen, they can be made with a larger optic zone than a hard PMMA lens, providing optimal vision both day and night. The larger size of the gas-permeable lens also makes it more comfortable than a PMMA lens. Because the upper eyelid does not engage the upper edge of a gas-permeable lens, it is less **likely** to pop out of the eye than a PMMA lens.

  Disadvantages

  The material from which the lenses are made is softer and more brittle than PMMA so that it tends to scratch and fracture more easily.

- ***Soft (hydrophilic):*** The basic plastic used in the manufacture of soft hydrophilic contact lenses is hydroxymethyl-methacrylate (HEMA). Depending on other chemical refinements, the degree of hydration of these lenses varies between 25 and 81%. The water-absorbing property increases the weight of the lens and they are, therefore, made larger than hard lenses in order to offset this problem. Soft lenses overlap the limbus. In general, the physiological performance of a soft lens is related to its thickness and its water content. The greater the water content the greater the oxygen permeability. In a very thin soft lens, adequate oxygen can diffuse through the lens to supply the corneal epithelium making the lens suitable for extended wear.

  Advantages

  Soft lenses are more comfortable to wear and are more stable in the eye than hard lenses. They do not require either the prolonged adaptation period or the rigid wearing schedule for successful wear.

  Disadvantages

  When compared with a hard contact lens, a soft lens is more delicate, more easily damaged and has a shorter lifespan. Visual acuity may not be as crisp and it is associated with a higher incidence of potential complications.

Principles of Fitting...

Curvatures

The essential feature of most contact lenses is that the posterior surface must conform to the shape of the cornea *(Figure 1).* The axial region of the cornea has a largely spherical curvature, peripheral to which there is a band of progressively decreased curvature. The central portion of the posterior surface of a contact lens must therefore be the most steeply curved. This so-called **'back optic zone'** thus has a spherical curvature measured as **'the back central optic radius'**. The diameter of the back optic zone is the **'back central optic diameter'**. The peripheral part of the posterior surface of a contact lens also has to follow the shape of the cornea so that it is less curved than the axial region and, in its simplest form, it has a single peripheral curvature, the radius of which is greater than that of the optic zone.

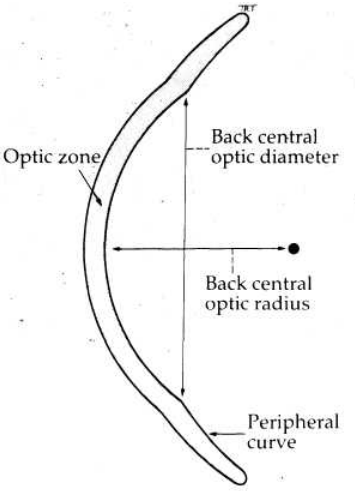

Figure 1: Contact Lens Curvature

Dimensions

The aim of fitting a contact lens is to choose the smallest and thinnest lens that gives optimum vision and comfort, without interfering with corneal physiology. The combination of keratometry and trial lenses is probably the best method of fitting. Keratometry is taken as a preliminary guide and the refraction to be ordered is then simply determined by the spectacle correction. A suitable modification should be made for the back vertex distance of particularly powerful prescriptions. The overall diameter of the contact lens is determined by the diameter and radius of the cornea, and the tension and position of the eyelids. The extent of the back central optic diameter of the contact lens is determined by the average size of the pupil and the radius of curvature of the cornea.

Fluorescein pattern

Much experience is required to correctly interpret the fluorescein patterns as these vary with the technique of examination and parameters of the lens. In principle, loose areas are seen as pools of fluorescein and areas of corneal touch as dark areas *(Figure 2).* The bearing relationship that is generally favoured is that of minimal apical clearance.

Figure 2: Fluorescein Pattern

Centring

Ideally, the contact lens should be well centred so that the optical axes of the eye and contact lens coincide. Whenever a contact lens is significantly decentred its optical function suffers, particularly in cases of high refractive errors.

Mobility

The mobility of the contact lens during blinking is important. A correctly fitted contact lens moves downwards relative to the cornea with the descent of the upper eyelid *(Figure 3b)* and is then taken rapidly upwards at a level above its static position as the upper eyelid ascends *(Figure 3c).* Finally it settles slowly to its initial position *(Figure 3a).* Any undue delay in this resettling may give rise to temporary blurring of vision. In addition, this mobility during blinking is believed to be of importance for the continued health of the cornea as it creates a satisfactory tear film which is vital to corneal integrity.

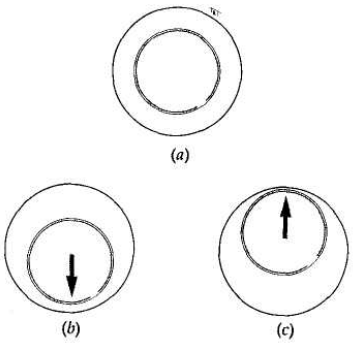

Figure 3: Normal contact lens mobility during blinking

Insertion and removal

When inserting a contact lens (hard or soft) it is first moistened and then placed on the tip of the index finger *(Figure 4, left).* The lids are then retracted and the eye gazes steadily at the approaching lens until it is applied gently to the cornea. When it is in position, the upper eyelid is released before the lower eyelid.

When removing a hard contact lens, the eye is opened widely so that the lid margins are beyond the edges of the lens. The index finger is then placed at the outer canthus and, with firm pressure, the skin and lids are stretched laterally *(Figure 4, right).* This causes the lens to become dislocated from the eye, either onto the lashes or into the waiting hand. A soft contact lens can be removed by simply pinching it out between the thumb and index finger.

Figure 4: Left-insertion of contact lense right-removal

Medical Indications

The medical indications for contact lenses can be divided into three main groups:

1. Aphakia and astigmatism.
2. Corneal disorders.
3. Miscellaneous.

Aphakia and astigmatism

This group consists of patients who are unable to obtain satisfactory vision with the use of spectacles.

1. *Unilateral aphakics* with good vision in the fellow eye can only achieve fusion with either a contact lens or an intraocular implant.
2. *High myopes* with macular degeneration are particularly suitable for contact lenses. This is because the aberrations associated with a high power lens are abolished and the concomitant increased magnification may improve visual acuity.
3. *Irregular astigmatism* associated with keratoconus can be corrected with a hard contact lens long after spectacles have failed and long before corneal grafting becomes necessary.

Corneal disorders

Soft bandage contact lenses may be beneficial in certain corneal disorders. The lenses are made a focal so that they do not impair vision. They can be used as short- or long-term treatment in the following conditions *(Figure 5).*

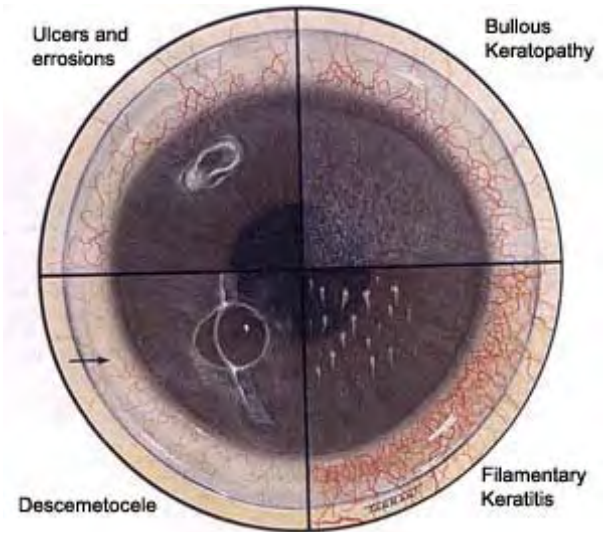

Figure 5

1. *Corneal irregularities.* A contact lens can replace a superficial irregular corneal surface by a smoother and optically more perfect surface. In this way visual acuity can be improved, provided the irregularities are not too severe.
2. *Epithelial healing defects* can be healed more quickly by protecting the regenerating corneal epithelium from the constant rubbing action of the lids and thus allowing the development of hemidesmosomal attachments to the epithelial basement membrane.
3. *Recurrent corneal erosion syndrome.* If the syndrome is associated with a corneal dystrophy (microcystic, Reis-Bucklers' or lattice), long-standing lens wear is usually necessary. In traumatic cases lens wear can usually be discontinued after a few weeks.
4. *Bullous keratopathy* can be managed by soft contact lenses which relieve pain by protecting the denuded corneal nerve endings from trauma by the eyelids. The lens may also flatten the bullae and convert them into diffuse fine epithelial oedema. The additional instillation of hypertonic (5%) saline may be beneficial in further reducing the amount of oedema and improving vision.
5. *Filamentary keratitis* can be treated by soft lenses in combination with artificial tears. It is hoped that the lens will reduce evaporation of any existing tears. The main problems that can occur are infection, drying of the lens and deposition of mucus on the lens. This form of treatment should only be undertaken by an expert who is able to provide an adequate and speedy follow-up should complications occur.
6. *Wound leaks* can be covered with a contact lens as a temporary measure to allow sufficient time for natural healing to occur.

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Medical Indications

Miscellaneous

1. *Ptosis.* Haptic contact lenses can be used in the management of ptosis in patients with no Bell's phenomenon in whom surgical correction is contraindicated because of the risk of postoperative exposure keratopathy during sleep.
2. *Cosmetic reasons* to hide an unsightly eye.
3. *Occluders.* Contact lenses can be used as occluders in the treatment of amblyopia in children who will not tolerate conventional patch occlusion.
4. *Vehicle for drug delivery.* Because a high concentration of a drug can be obtained by soaking a soft contact lens and then applying it to the cornea, it can be used as a vehicle for drug delivery.
5. *Protection of normal corned epithelium* in eyes with trichiasis or threatened exposure keratopathy.
6. *Prevention of symblepharon* during the acute phase of destructive conjunctival disorders, especially those due to chemical burns.

Complications

Although any type of contact lens may give rise to complications, serious complications are more common with extended wear lenses that extend beyond the limbus.

Allergic conjunctivitis

The most common cause of problems with soft contact lenses is allergy to the preservatives in contact lens cleansing solutions. It is now apparent that at least 10% of soft contact lens wearers are allergic or sensitized to thiomersal and are unable to use solutions containing this preservative.

Clinical features: The main symptoms are redness, burning, and itching soon after lens insertion. These symptoms may develop within days to months following the initial exposure to thiomersal. Examination shows mild perilimbal injection following the edge of the contact lens and a fine papillary conjunctival reaction.

Management: Solutions containing thiomersal should be avoided and the lenses should be disinfected with heat and non-preserved saline. The thiomersal can be extracted from the lens by soaking it in hydrogen peroxide 3% for 10 minutes.

Giant papillary conjunctivitis

Giant papillary conjunctivitis (GPC) is a relatively rare complication. The most commonly fitted lenses in patients with GPC are ultra thin, low water content, soft lenses.

Patients with asthma, hay fever, or animal allergies appear to be at increased risk. It has been postulated that GPC has an immunological origin in which contact lens deposits, especially proteins, act as allergens. Thiomersal has been implicated in altering lens proteins and predisposing patients to GPC.

Clinical features: The patient may present months or years after beginning lens wear with ocular irritation, itching, photophobia, increased mucus production, and decreased lens tolerance. Eversion of the upper lid is necessary to make the diagnosis. The spectrum of changes on the upper tarsal conjunctiva ranges from a mild papillary response to the full blown picture of GPC characterized by giant papillae. Excessive mucus in the eye and on the contact lens is also noted. In some cases, Tranta's dots and limbitis similar to that seen in vernal disease are present.

Management: Contact lens wear should be discontinued for 3 months. In patients with severe GPC treatment with topical sodium cromoglycate (Opticrom) or a weak steroid such as fluoromethalone may be helpful. After 3 months, an attempt can be made to refit the patient either with a soft lens of a different polymer or a hard lens and preservative containing disinfecting solutions should be eliminated. If these measures fail it may be necessary to discontinue contact lens wear permanently.

Complications

Corneal complications (Figure 6)

1. *Epithelial oedema* due to hypoxia is usually reversible. *Peripheral corneal vascularization* occurs in some eyes with prolonged wear lenses and occasionally with daily wear lenses. Although the new vessels usually regress once contact lens wear is discontinued, a small number of eyes develop extensive deep vascularization.
2. *Sterile corned liberation,* either in the centre or periphery of the cornea, may occur. Fortunately it usually heals once wear has been discontinued.
3. *Infection* is the most serious, but fortunately, a very rare complication.
4. *Warping of the cornea* resulting in severe and permanent astigmatism may occur in some eyes with extended wear lenses.

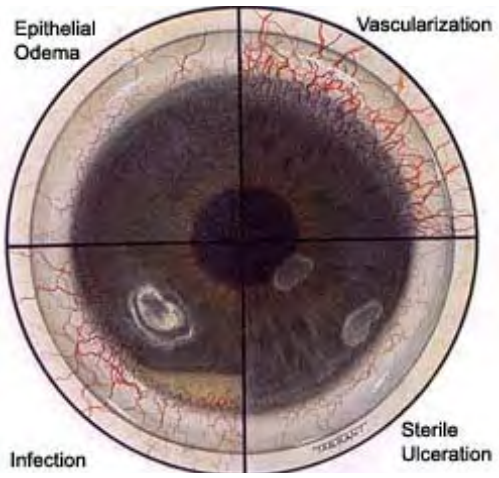

Figure 6: Corneal Complications of Lens Wear

Changes within the Contact Lens

1. *Deposits of mucoproteins* can adhere to the lens surface making the eye uncomfortable. The deposits generally develop in an unpredictable manner and some patients can only wear a lens for a few weeks before it becomes covered with deposits. Sometimes the deposits can be removed by cleaning, but those with chronic deposit formation may not be able to wear contact lenses on a long-term basis.
2. *Calcium deposits,* which appear as small round hard opacities, can also accumulate on the lens surface.
3. *Lens digestion.* Although the lens pore size is generally too small for microbial organisms to enter, it has been shown that organisms such as fungi can attach themselves to the surface of the lens and digest the lens material while growing into it.

Hints for Wearing Contact Lenses

1. Always wash your hands before insert ing contact lenses. Hypo-allergenic soap is fine for removing surface dirt and excess skin oils because it leaves no film on the hands. Medicated soaps are not recommended by eye doctors for use before inserting contacts as they contain many different medicaments which often irritate the eyes and the sensitive surrounding skin area. If your contacts burn and sting immediately after you insert them but feel better as the day progresses, this is often an indication of cosmetics on the lenses. The lessening of the discomforting symptoms is due to the tears washing away some of the foreign particles.
2. Insert contact lenses before applying any makeup. By following this rule, you will be able to see better and more expertly apply your eye makeup too, and at the same time you will avoid getting any makeup in the eyes or on the lenses.
3. Eyeliners should never be applied on the lower lid as they may stop up the sensitive glands. There is also the chance that the liner will get in the eye and sensitive skin will be inflamed.
4. Use great care when applying mascara regardless of the type you prefer the roll-on or cake.
5. Many eye doctors instruct patients not to wear contact lenses in the beauty shop. Sitting under a hair dryer dries both the tears and the plastic of the lens—the lens then rubs the eye in stead of floating properly. Fumes from permanent waving liquids are also very irritating to contact wearers.
6. Avoid applying heavy facial creams, particularly those containing lanolin, around the eyes. These are often so greasy that they can coat the lenses with an oily film. Creams should never be used before inserting lenses.
7. Avoid getting hair spray in the eyes by covering them with a plastic shield. Hair spray can build up on lenses, and sometimes can be removed only by polishing the lens in the laboratory.

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