Drug and Contact Lens Interactions

Muntingh GL, BPharm, MSc(Med)(Pharmacology), PhD(Pharmacology)
University of Limpopo, Medunsa Campus.

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Reprint request: Dr G.L. Muntingh, Pharmacology and Therapeutics, P Box 225, MEDUNSA, 0204.
Tel: +27(0)12 521-4359, Fax: +27(0) 12 521-4121, e-mail: muntingh@medunsa.ac.za

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Introduction

"A patient who damages or loses his or her expensive hydrophilic contact lens will be annoyed - but the complaint will be much louder if the damage is caused by drugs without appropriate warning". This opening sentence from a short article by DV Ingram from the Sussex Eye Hospital, is indicative of a potential problem for wearers of soft contact lenses in that their medication, systemic or topical (into the eye), may interact with and damage the plastic material of their lenses.

With the increase in the number of contact lens wearers, it has become necessary to make both users and prescriber's of medicine aware of possible interactions that might exist between oral and/or topical medications and contact lenses. It is also true that certain eye conditions e.g. dry eyes, irritated eyes and chronic eye infections in contact lens wearers, may arise secondary to interactions between contact lenses and drugs.

A background knowledge of contact lenses is necessary in order to understand the basis of these interactions and how they may affect the contact lens, whether through direct or indirect mechanisms. Through this knowledge inadvertent damage to contact lenses and to the eye, may be prevented.

Contact lenses

In order to function normally, the eye is dependent on an adequate supply of fluid to cover its surface.

Many factors may alter this supply of fluid. Drugs administered locally or systemically during can affect:

a) Tear composition.
b) The response to other drugs.
c) The contact lenses themselves.

Types of lenses

There are mainly three types of lenses:

a. Hard lenses - less than 10% water content
b. Hard gas permeable lenses - allows increased movement of oxygen through the lens
c. Soft lenses - up to 80% water content

a. Hard lenses

These are made from a hard plastic polymethylmethacrylate (PMMA). They are thin, saucer-shaped discs which float on the tear layer and which partly cover the cornea. Adaptation to the use of these lenses is slow, partly because they are not really gas permeable, which could result in relative corneal hypoxia. Also, any drug administered topically or systemically that can cause corneal oedema may disturb the fit of the hard lens.

b. Gas permeable lenses

These lenses combine the excellent clarity of vision and durability of the hard lenses with comfort because of their gas permeable properties. They are manufactured from materials such as CAB (cellulose acetate-butritrate) and silicone polymers.

c. Soft lenses

Soft lenses were developed in response to the restrictions posed by the hard lenses. They are made of hydro-gels such as HEMA (hydroxy-methylmethacrilate) and vinyl copolymers. These materials absorb water and when they are fully hydrated,

could contain up to 80% water. This relatively high water content lends itself to excellent gas permeable properties, making them more comfortable to wear and easier to get used to. As these lenses are easier to wear, they are usually prescribed first unless certain conditions favour the use of hard lenses.

With soft lenses the effects of locally applied drugs are usually exaggerated:

a) The lens can increase the contact time of the medication.
b) Absorption and concentration of medication into the lens can occur during treatment with subsequent gradual release over a prolonged period (bandage lenses).
c) Increased drug absorption may occur due to the compromised cornea in contact lens wearers.

It is also important to remember that many drugs that are administered systemically may also be excreted into the fluids of the eye and may therefore also subsequently affect the lens itself.

Table I

Drug and contact lens interaction categories
a. Increased lens deposits
b. Discolouration of lenses
c. Dehydration of lenses
d. Corneal oedema
e. Decreased eye movements and/or blink reflexes
f. Decreased lacrimation

Basis of drug interactions with contact lens

The introduction of contact lenses not only revolutionised optometry but also provided the body with an extra foreign surface to which it could react. Contact lenses also increased the option for interactions with medication. These interactions can basically have two main effects. They can both have an effect on the eye and therefore influence characteristics of the lens, or they can affect the contact lens itself. Chemical substances having the latter effect might have a secondary effect on the eye itself if not detected in time.

Table I describes categories of interactions systemic or topically administered medication can have with the eye and contact lens.

Table II

From body sources (e.g. tears)	From external sources
a. Proteins	a. Dust
b. Lipids	b. Aerosol sprays
c. Mucins	c. Make-up and body creams
d. Calcium salts	d. Bacteria
	e. Fungi
	f. Iron

a. Increased lens deposits

The adsorption of substances to the lens surface is probably the greatest problem that contact lens users experience. This occurs with all the different types of contact lenses. This interaction between foreign surfaces and biological components is not an extraordinary one as the formation of dental plaque, the adherence of debris on transplanted heart valves and clotting of blood when in contact with these surfaces are well known occurrences. It is, however, important for the prescriber to note that certain medication increases this problem. (Table II)

If these contaminants are not removed, or if the deposits are increased because of medication, it could lead to serious eye problems for the patient. Such contaminants not only have the ability to damage the eye but can also damage the lenses and affect the visual acuity. The normal gas exchange between the eye and the environment can deteriorate which could lead to corneal oedema or, in severe cases, the loss of corneal clarity.

The contaminants can also act as irritants because they create an uneven surface on the lens. By deforming the lens, they could cause visual disturbances.

b. Discolouration of lenses

This problem is mainly confined to soft contact lenses, where it was found that some drugs (e.g. rifampicin) can enter lenses and cause discolouration or react with compounds on the surface and cause lens spoilage. Although many drugs cause permanent discolouration, the damage caused by other drugs can be reversed but usually not without a great deal of effort. Contact with cigarette smoke can also cause discolouration but mechanical discomfort would be a bigger problem with smoke before actual staining will take place. Nicotine stains on the fingers of smokers could, however, contaminate the lenses by careless handling of contact lenses.

c. Dehydration of lenses

This type of damage to contact lenses is usually reversible. More importantly, damage can be done to the eye. Withdrawal of water from the lens secondary to decreased lacrimation caused by, for example, isotretinoin, will lead to lenses absorbing water from the tear film, leading to a breakdown in the tear film integrity.

Table III

Drugs and how they can effect contact lenses	
Topical drugs	***Adverse effect***
Adrenaline	Adrenochrome pigments formed: dense brown discolouration
Antazoline	Decreased mucoid or lachrymal secretions
Eye ointments	Encourage lens deposits
Fluorescein	Stains lens and may cause permanent damage
Hypertonic eyedrops	Dehydrates lens
Na-Sulphacetamide	Dehydration of lens
Phenylephrine	Discolouration, corneal oedema
Pilocarpine	Corneal oedema, dehydrates lens
Rose Bengal	Stains lens
Tetrahydrozoline	Discolouration of lens
Oral drugs	***Adverse effect***
Alcohol	Encourages deposits on the lens
Amantadine	Corneal oedema - poor lens fit
Amiodarone	Decreased eye movement and corneal/blink reflex
Amphotericin-B	Corneal oedema - poor lens fit
Anticholinergics	Decreased lacrimation, encourage deposits on lens
Antihistamines	Decreased lacrimation, decreased eye movements and corneal/blink reflex, encourage deposits on lens
Aspirin	Sore or irritated eyes
Benzodiazepines	Sore or irritated eyes, decreased eye movements and corneal/blink reflex
Beta blockers	Decreased lacrimation, eye movements and corneal/blink reflex
Carbamazepine	Decreased eye movements and corneal/blink reflex
Chloramphenicol	Corneal oedema
Chloroquine	Sore or irritated eyes
Chlorpromazine	Decreased lacrimation, corneal oedema, encourages deposits on lens
Chlorthalidone	Corneal oedema
Clomifene	Corneal oedema
Clonidine	Decreased lacrimation, sore or irritated eyes
Cocaine	Corneal oedema
Cosmetics	Encourage lens deposits
Cyclic antidepressants	Decreased lacrimation, decreased eye movement s and corneal/blink reflex, encourage deposits on lens
Dagga	Decreased lacrimation, encourages lens deposits
Digoxin	Corneal oedema
Diltiazem	Sore or irritated eyes
Disopyramide	Decreased lacrimation, encourages deposits on lens
Dopamine	Encourages deposits on lens
Ephedrine	Increased lacrimation with decreased lens fitting
Erythromycin	Corneal swelling
Etretinate	Decreased lacrimation, encourages deposits on lens
Fluoro-uracil	Sore or irritated eyes
Hydralazine	Sore or irritated eyes, increased lacrimation
Iodine preparations	Stains the lens
Isotretinoin	Decreased lacrimation, encourages deposits on lens
Ketoprofen	Sore or irritated eyes
Lithium carbonate	Corneal oedema, decreased eye movement and corneal/blink reflex
Meclozine	Decreased lacrimation, encourages deposits on the lens
Meprabomate	Decreased eye movement s and corneal/blink reflex
Methadone	Decreased eye movements and corneal/blink reflex
Methotrexate	Decreased lacrimation, sore or irritated eyes, encourages lens deposits
Methyldopa	Decreased lacrimation, encourages deposits on the lens
Morphine	Decreased lacrimation, encourages deposits on the lens
Muscle relaxants	Decreased eye movement and corneal/blink reflex
Nitrofurantoin	Stains the lens (brown)
Oral contraceptives	Decreased lacrimation, corneal oedema, encouraged lens deposits
Pentazocine	Decreased eye movement and corneal/blink reflex
Phenolphthalein	Stains the lens
Phenothiazines	Decreased lacrimation, corneal oedema, encourage lens deposits
Pimozide	Decreased lacrimation, encourages deposits on ens
Primidone	Corneal oedema
Pyridium	Stains lens
Reserpine	Decreased eye movements and corneal/blink reflex
Rifampicin	Stains lens (orange)
Sedative hypnotics	Decreased eye movements and corneal/blink reflex
Smoking	Sore or irritated eyes, encourages lens deposits
Sulphasalazine	Stains lens (orange)
Tetracyclines	Stains lens
Thiazide diuretic	Decreased lacrimation, encourages deposits on the lens
Verapamil	Sore or irritated eyes
Vitamin-A deficiency	Sore or irritated eyes (Dry eyes)
Vitamin-A overdose	Sore or irritated eyes (Dry eyes)

This will lead to a thickening of the tear film which will increase lens deposits and decrease corneal rinsing. Severe cases of serious corneal damaged have been reported; when the lenses are removed some of the corneal layers are removed with it.

d. Corneal oedema

Corneal oedema (caused by, for example, oral contraceptives) can occur for longer periods than in other tissue as no lymphatic drainage takes place. A resulting poor lens fit on the cornea can lead to eye discomfort and lens shift, especially in the case of hard contact lenses.

e. Decreased eye movements and/or blink reflex

The formation of the tear film is controlled mainly by the blink reflex and eye movements. A proper lens fit depends on the presence of a normal tear film. Drugs (e.g. tricyclic antidepressants) that decrease the eye movements and blink reflex will lead to eye discomfort and improper lens fit.

f. Decreased lacrimation

Some patients have naturally dry eyes and are usually not suitable candidates for contact lenses. The use of artificial tear solutions is usually not recommended with contact lenses, as some contain oils (which can cause lens deposits) and other preservatives (which may penetrate the lens). There are solutions that are designed specifically for use with lenses. Certain drugs, e.g. the older generation antihistamines, do cause a decrease in lacrimation leading to dry eyes. This could lead to more concentrated tears, which increase the binding of proteins, mucins and lipids to the lenses. These lens deposits themselves can, under certain conditions, cause a decrease in tear production. It is important to note that, apart from medication, other factors which can lead to dry eyes should always be considered. Hot, dry and windy environmental conditions will often dry the eyes if lenses are worn; so could corneal trauma and hypersensitivity to chemicals. Eye dryness while wearing lenses could manifest itself as eye discomfort, pain, blurred vision and coloured rings (seen by the lens wearer).

Summary

It is important to be aware that drug interactions with contact lenses do exist. Using this knowledge when prescribing medication will decrease the incidence of damage to the eye and contact lens and result in more comfort being afforded to the patient wearing contact lenses.

See CPD Questionnaire, page 30

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