Administering eye medications

Watkinson S, Seewoodhary R (2008) Administering eye medications. *Nursing Standard*. 22, 18, 42-48.
Date of acceptance: May 25 2007.

Summary

This article discusses eye medications and considerations for their use in ophthalmic patient care. It is aimed at all healthcare practitioners who are involved directly or indirectly in the care of patients with eye problems. The issues discussed are indications for the instillation of eye medications, legal aspects, patient assessment, concordance, classification of ophthalmic medications, drug interactions and the nursing procedure.

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Keywords

Eyes; Medication; Ophthalmic nursing; Ophthalmology

These keywords are based on the subject headings from the British Nursing Index. This article has been subject to double-blind review. For author and research article guidelines visit the *Nursing Standard* home page at **www.nursing-standard.co.uk**. For related articles visit our online archive and search using the keywords.

THE INSTILLATION of eye drops and ointment is an important skill for many healthcare practitioners. This skill can be performed in any clinical setting, for example, accident and emergency, intensive therapy units, older people's wards and the community. Healthcare practitioners should be aware of the implications of using eye medications for the preservation of sight during the healing process. Indications for the instillation of eye drops and ointment are outlined in Box 1.

Legal aspects

Topical eye medications are governed by the same controls as medications administered by other routes (Marsden and Shaw 2003). This emphasises the legal aspects of the practitioner's role. It is documented that one fifth of all clinical negligence litigation in the UK arises from errors in the use of prescribed medicines (Audit Commission 2002). The law requires that medicines are given to the right person, at the right time, in the correct form, using the correct dose and via the correct route (Griffith *et al* 2003). Eye medications are important for the patients who need them and healthcare practitioners should exercise caution to prevent drug errors.

The Nursing and Midwifery Council (NMC) (2002) stresses that drug administration is not solely a mechanistic task to be performed in strict compliance with the written prescription of a medical practitioner. It requires thought and the exercise of professional judgement. The health practitioner should assess whether the patient has been informed and is aware of the purpose of the eye medications. This is an important principle in relation to the prescription (NMC 2002).

As part of the duty of care owed by healthcare practitioners to ophthalmic patients, knowledge of pharmacodynamics and pharmacokinetics, or

BOX 1

Indications for the instillation of eye medications

- Diagnostic procedures, for example, dilating drops and fluorescein dye.
- Emergency use, for example, eye irrigation for chemical burns.
- Healing, for example, vitamin C eye drops for severe chemical injury.
- Lubrication, for example, Lacri-Lube® (eye ointment consisting of white soft paraffin and liquid paraffin) to promote comfort and prevent recurrent corneal erosions.
- Pain relief, for example, local anaesthetic for eye examination for contact lens-related corneal abrasion.
- Pre and post-operative ophthalmic surgery, for example, pupil dilation to allow ease of fundoscopy (viewing the retina) during surgery.
- Procedural, for example, anaesthetic eye drop before eye wash.
- Prophylaxis, for example, seasonal conjunctivitis.
- Replacement therapy, for example, artificial tears for dry eyes.
- Surgery, for example, local anaesthetic for cataract surgery.
- Therapeutic, for example, glaucoma.

(Moorfields Eye Hospital 1992)

modes of action, is essential in increasing understanding of the administration of eye medications (NMC 2004). Pharmacodynamics describes the biological and therapeutic effects of medications and is important as it permits a more intelligent use of eye medications (Cooper 1997). Some eye preparations are absorbed rapidly through the eye surfaces and may affect the person systemically. For example, timolol, a beta blocker commonly used in primary open angle glaucoma, can cause adverse systemic side effects such as bronchiolar spasm, which may precipitate an asthma attack. When administering such drops, the punctum (tear duct) should be occluded by applying the forefinger for approximately three to five minutes to limit systemic absorption through the nasal passages (Cooper 1997). Pharmacokinetics describes the processes of drug absorption, distribution, metabolism and excretion (Cooper 1997).

Drugs can be water soluble, such as an anaesthetic eye drop, which acts locally, or bi-phasic, indicating that they will penetrate the bi-lipid component of the cell membrane to reach the target sites. Examples of such drugs are miotics (drops constricting the pupil), mydriatics (drops dilating the pupil) and corticosteroids. Drug absorption is influenced by the following factors (Cooper 1997):

- Chemical structure of the drug.
- pH factor.
- Health of ocular tissue.
- Mode of administration.
- Physiochemical properties.

Patient assessment

Patient assessment is essential to ensure that the correct diagnosis is made and medications are prescribed correctly (Stevens 2005). A comprehensive patient assessment will include the following:

- It is important to obtain and record details of the onset, duration and severity of the presenting eye condition. Current prescribed eye medication and its frequency should be noted.
- If similar eye problems treated in the past have recurred, this may necessitate repeating the prescription. If the prescription and frequency of eye medication have changed, then the patient needs to understand the reasons for this. For example, in glaucoma, if the intra-ocular pressure is not being maintained, the drug regimen will be reviewed and a new one may be prescribed to control the condition (adjunct therapy).
- If the patient is self-medicating, the health practitioner should ascertain where the drug was obtained, and its frequency of use should be noted. It should also be noted whether it was prescribed by the GP, obtained over the counter and what information was given about the drug. For example, find out whether the patient was taught how to instil the eye drops or ointment (Donnelly 1987).
- The healthcare practitioner should examine the pharmacodynamics and pharmacokinetics of any prescribed medication and possible drug interactions should be considered (Hussar 1993). It is therefore important to check for any other prescribed systemic medications being taken and note the frequency of administration.
- A history of pregnancy has to be recorded since medication can pass across the placental blood barrier during the first trimester of pregnancy, for example, corticosteroids and beta blockers. Similarly, a breast-fed baby may be affected by drugs such as corticosteroids and antibiotics.

Medical history It is important to obtain and record details of the patient's medical history to identify and record any diseases and any potential adverse reactions following the administration of eye medications (Table 1).

Any history of allergies to eye drops or ointment, or the preservatives contained within them, should be noted. Similarly, if the patient wears contact lenses, details should be obtained as to whether the lenses are hard, soft or gas permeable. Drugs and their preservatives can be absorbed through contact lenses and this will increase toxicity to the cornea leading to toxic keratitis and ulceration.

TABLE 1

Systemic diseases and adverse reactions

Condition	Drug interactions
Hypertension	Guttae phenylephrine may increase blood pressure.
Diabetes	Mannitol may affect glucose metabolism.
Depression	Acetazolamide (Diamox®), a glaucoma medication, may worsen the symptoms of depression.
Thyroid disease	Use of a systemic beta blocker may make thyroid medications less effective.
Asthma	Use of beta blockers may precipitate an asthma attack.
Herpes simplex-related infection	Use of corticosteroids may cause secondary corneal infection in herpes keratitis.

(MEH 1992)

Concordance

Winfield *et al* (1990) found that in cases of non-concordance doctors assumed that patients lacked motivation and did not ask them if they had any problems administering the medication. The healthcare practitioner is responsible for assessing each patient carefully to identify any difficulties with eye medications and liaising with the consultant and pharmacist appropriately. Lorenc and Branthwaite (1993) found that patients' lack of knowledge of their medical ophthalmic condition and the treatment regimen were significant reasons for patients failing to concord.

A systematic review by Olthoff *et al* (2005) indicated that the proportion of patients who deviated from the prescribed medication regimen ranged from 5% to 80%. This was particularly observed with hypotensive treatment among glaucoma patients. The reasons for non-concordance were related to patients' lack of knowledge about their eye disorder and the therapeutic benefits of the prescribed medication. Additionally, side effects are common on starting glaucoma medication, for example, the initial application of pilocarpine is painful as a result of ciliary spasm and the low pH of the medication. Furthermore, Banning (2004) found that older people had a propensity to mismanage medication and those who had memory impairment were more at risk of non-concordance.

Improving concordance This can be achieved by information sharing and educational initiatives (Banning 2004). An example is the International Glaucoma Association, which provides a platform for patients to participate and share their experiences. Krska *et al* (2001) supported the notion that pharmacists can also counsel patients, thus promoting concordance with medication. When managing concordance, Krska *et al* (2001) stressed that communication between healthcare professionals improved when practice nurses were involved in drug monitoring. The outcome of their study showed a decrease in repeat prescriptions, and prescribed medication was rationalised, thus improving concordance with the medication regimen. This is viewed as evidence-based ophthalmic care, particularly in relation to glaucoma drug therapy when patients will be using one or two types of medication to control the eye pressure. Previously, patients were using multiple medications resulting in adverse side effects leading to non-concordance (Walker and Wynne 1994).

The individual's internal locus of control has some predictive value for concordance behaviours (Stanton 1987). Individuals with an internal locus of control view themselves as having control over what happens to them. This positively influences individuals to instil their eye drops.

Health motivation is another important factor relevant to preventive health action such as adherence to drop treatment (Seeman and Seeman 1983). If individuals are aware that not using medication as instructed can lead to irreversible loss of vision, then this may motivate them to use the prescribed drops or ointment. There are benefits to tailoring an individualised patient education strategy, such as providing a medication information leaflet on the eye disorder, as part of the discharge care planning initiative. Finally, providing the patient with information about the care and management of eye medications should also help to enhance concordance with prescribed treatment.

Care and management of eye medications

Care and management of eye medications should include the following:

- Storage at correct temperature, preferably in a fridge once opened. Also avoid direct exposure to sunlight as this oxidises the active ingredients of medication.
- A contact lens wearer should avoid drops with preservatives as these increase corneal contact time and may lead to corneal toxicity.
- Length of use must not exceed prescribed time.
- Disposal of eye medication after use is important.
- Sharing drops is not advisable as eye medications have a specific mode of action, for example, a child needing refraction will require atropine ointment before attending orthoptic assessment and this medication must not be used by the adult parent with an eye infection.
- All medications, including ophthalmic medications, must be kept away from children in a safe cupboard.
- Labels must be read before instilling eye medications every time as glue and nail varnish containers resemble eye medication containers.
- Hand washing is essential to prevent contamination. Avoid the dropper touching the lids and eyelash.
- Effects on vision, for example, driving and handling dangerous machinery are hazardous with dilating drops due to blurred vision.

- Side effects such as headache, lack of focus, dryness, irritation, allergy, disorientation, mental confusion, shortness of breath and hallucination can occur with ophthalmic medication. Patients should be encouraged to read attached literature and report side effects to the doctor.
- A patient receiving corticosteroid eye drops will be asked to return for review as steroid-induced glaucoma may develop. Also, some eyes are prone to secondary infection, corneal thinning and possible corneal perforation with corticosteroid eye drops.

Classification

For patients receiving eye medications, it is important for the healthcare practitioner to investigate the classification of drugs, mode of action and side effects to provide safe practice within an evidence-based framework (Cooper 1997). Table 2 outlines a classification of ophthalmic medications.

Side effects

All ophthalmic medications may cause side effects that vary in intensity and severity. Allergic reactions are most commonly reported by patients in practice. Fluorescein is an ideal medium for the growth of *Pseudomonas aeruginosa* and eye drops should be used from a single dispenser. Beta blockers should be used with great care and they are contraindicated in patients with asthma and for patients taking digoxin medication, since they may cause heart block. Phenylephrine is usually avoided in patients with hypertension as it can cause hypotension and affect cardiac rhythm. Acetazolamide (Diamox®) is a sulphur derivative and can cause kidney stone formation and haematuria. It also depletes white blood cells and platelets causing recurrent infection and bleeding tendencies. Endogenous depression and suicidal tendencies are also possible side effects in susceptible individuals. It can also deplete bone marrow causing aplastic anaemia. Because of its additional diuretic effect, it causes potassium depletion and gives rise to a 'pins and needles' sensation.

Local anaesthetics will diminish the blinking reflex mechanism and cause dryness of the eyes. They can also damage the corneal epithelium, thus delaying healing if used in excess.

Cooper (1997) cautioned not to exceed more than one drop during instillation. One drop is the equivalent of 50 microlitres and will overload the fornix since the latter can only hold 25 microlitres (Downie *et al* 1987). The eye can only absorb 11 microlitres when one drop is instilled and therefore it is unadvisable to instil two or three drops as this will only cause wastage and more systemic absorption. When two or more medications are prescribed for an eye disorder, there should be a three to five minute interval between instillation of each medication to the same eye (Marsden and Shaw 2003). All drops should be instilled before the administration of ointment to maximise absorption (Marsden and Shaw 2003).

Drug interactions Hussar (1993) warned of the additive effect when, for example, an older patient is being treated with an anti-psychotic, anti-Parkinsonian and anti-depressant drug. These drugs have anticholinergic effects, and if atropine is prescribed, it can cause an atropine-like delirium and confusion. This can be mistaken for an exacerbation of the patient's psychiatric disorder, and treating this by increasing the prescribed medication will aggravate the situation.

Procedure for instillation of eye medication

Instillation of eye drops Eye drop instillation is applied only when the eye is clean to achieve maximum effect. Stickiness and debris may inactivate the active ingredient of the drug. However, there is no need to clean the eye if it is visibly clean (Kunimoto *et al* 2004).

All eye drops and ointment should be checked, preferably by two healthcare practitioners, both being present during the procedure. The hospital protocol should be adhered to as a safety precaution and the NMC (2004) guidelines should be taken into consideration. The equipment required includes a dressing trolley and dressing packs, should the eye(s) need to be cleaned, the patient's notes, prescription sheet and the eye drops and ointment prescribed. The stages involved are highlighted by Stevens (2005):

- The patient is positioned comfortably in a chair, with the head well supported, and in an area of good lighting. An explanation of the procedure is given to increase awareness of the benefits of the medication before obtaining the patient's consent.
- It is important to check that details of the patient's identity correlate with those recorded on the patient's wristband, notes and prescription sheet. All pages of the prescription sheet should also be checked for doctor's orders and any patient allergies.
- It is then important to check that the correct drops/ointment have been prescribed at the correct strength, and are being instilled into the correct eye(s) at the correct time.

- When separate bottles of drops are being used for each eye, they must be labelled 'right' and 'left' eye.
- Both healthcare practitioners should check the drop bottle for: expiry date; clarity of the drops; and intact dropper/pipette.

Ointment should be checked for its expiry date.

- Hand washing is essential before cleaning the eyes, if necessary, and then instilling the drops. At this stage, re-check which drops are to be instilled into which eye, if necessary.
- Ask the patient to tilt the head back and look up, or behind (depending on the patient's position) to prevent damage to the cornea during the instillation of drops.

TABLE 2

Ophthalmic medications

Classification	Mode of action	Example	Indication for use
Mydriatics (adrenergic)	Directly acts on dilator muscles via the sympathetic nervous system to dilate the pupil.	Phenylephrine	Fundoscopy. Pre-operative cataract surgery
Cycloplegics	Blocks the action of the sphincter pupillae and ciliary muscles by interfering with their receptor sites.	Tropicamide	Fundoscopy
Miotics	Stimulates the parasympathetic nervous system and excites the sphincter pupillae muscle.	Pilocarpine	Primary acute angle closure glaucoma
Chemotherapeutic agent	Antibiotic Anti-fungal Anti-viral	Chloramphenicol Amphotericin B Aciclovir	Bacterial infection Fungal corneal ulcer Herpes corneal infection
Beta blockers	Blocks beta receptor sites on the ciliary body to reduce aqueous outflow.	Timolol	Primary open angle glaucoma
Local anaesthetics	Blocks the sodium gate in the neural pathway to anaesthetise ocular tissues. This is site specific.	Amethocaine	Removal of corneal foreign body
Dyes	Stains the ocular surface to diagnose corneal abrasions and dry eyes.	Fluorescein, Rose Bengal	Diagnostic for corneal lesions in dry eyes
Lubricants	Adds viscosity to tears	Hypromellose	Dry eyes. Promotes corneal healing
Drugs reducing intra-ocular pressure (IOP):			
1) Carbonic anhydrase inhibitors	Inhibits action of carbonic anhydrase enzyme to reduce aqueous production.	Acetazolamide Dorzolamide	Glaucoma
2) Prostaglandin analogues	Increases aqueous outflow through the ciliary muscles.	Latanoprost	Glaucoma
3) Miotics	Improves aqueous drainage.	Pilocarpine	Glaucoma
4) Beta blockers	Reduces aqueous inflow.	Timolol	Reduces IOP in primary open-angle glaucoma
5) Osmotic agents	Reduce water content of the vitreous humour.	Mannitol, glycerol	Glaucoma management
6) Alpha agonists	Stimulate the alpha receptor sites in the ciliary body to reduce aqueous production and increase aqueous drainage.	Apraclonidine Brimonidine tartrate	Glaucoma management
Irrigation solutions	Neutralise both acid and alkaline levels in burns to stabilise the pH.	Amphoteric eye solution Normal saline (this will only dilute and wash the chemical off the eye)	Chemical eye injury
Corticosteroids	Anti-inflammatory. Reduces the function of the T cells.	Prednisolone	Corneal graft rejection. Iritis
Replacement therapy	Replenishes vitamin C in the ocular tissue and aqueous humour.	Potassium ascorbate	Severe chemical eye injury

- The lower lid is gently pulled down and the dropper is held perpendicular to the eye. One drop is instilled into the middle of the lower fornix at a distance of one inch (as indicated). Ensure that the dropper does not touch the eyelid or lashes to avoid contamination (Figure 1).
- It is important to note that drops may also need to be instilled into the upper fornix, for example, for a pre-operative patient undergoing surgery under local anaesthetic, or, post-operatively over the punctum following a dacryocystorhinostomy (surgery to restore the flow of tears into the nose from the lacrimal sac when the nasolacrimal duct does not function). It is advisable for health practitioners to use the hand they are most competent with to instil the drop.
- Always inform the patient that the drop is about to be instilled and also warn that the drop may feel slightly cold, and, in the case of dilating drops, may sting temporarily for about 60 seconds or less. It is advisable to add that these effects are to be expected and that there is no reason for alarm.
- After carefully instilling the drop, the patient is asked to gently close the eye and avoid squeezing. A clean tissue or gauze is used to wipe away any excess drops. The patient's eye should be kept closed for a minute or two after which time normal blinking is allowed.
- The patient should also be given a tissue to wipe away any further excess moisture from the cheek.
- Punctal occlusion by the patient will be advised when beta blocker or phenylephrine drops are instilled as a precautionary measure.
- Hand washing is important after the procedure to prevent cross-infection, and the eye medication administered should be signed for. Documentation of drug administration should be kept up to date for medical and legal reasons, and the local protocol adhered to at all times.
- It is important to observe for any possible side effects from the administered eye medication and to report and record them appropriately.
- If drops are for re-use they should be labelled and returned to the fridge and then kept for up to one week only. Preservative-free drops are often prescribed for patients with an allergic history and these drops are more prone to contamination. Therefore, the health practitioner should exercise caution at all times.

FIGURE 1

Instilling eye drops

The lower lid is pulled down gently and the dropper is held perpendicular to the eye. One drop is instilled into the middle of the lower fornix from a distance of one inch. Ensure that the dropper does not touch the eyelid, or lashes to avoid contamination.

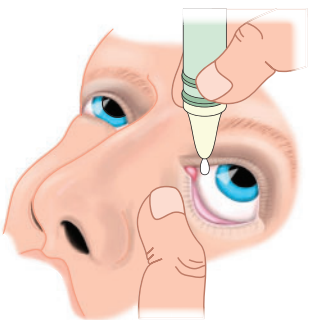
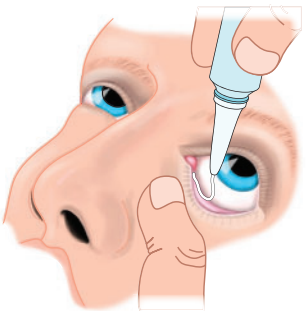


FIGURE 2

Applying eye ointment

A thin line of ointment can be squeezed directly from the patient's own tube along the conjunctival sac from the inner canthus to the outer canthus in the lower fornix with the patient looking up or behind. Alternatively, a line of ointment can be squeezed on to an appropriate applicator. To prevent contamination, avoid touching the eye with the top of the tube.



Instillation of ointment This procedure can be performed by the healthcare practitioner in two ways: either a small line of ointment can be squeezed directly from the patient's own tube from the inner canthus (the angle at either end of the aperture between the eyelids) to the outer canthus in the lower fornix with the patient looking up or behind (Figure 2); or a line of ointment can be squeezed onto the appropriate applicator. Again, the patient will be asked to look up or back. Gently place the applicator in the lower fornix, ensuring there is no contact with the cornea. The patient is asked to close the eye gently. The applicator is withdrawn at the outer canthus with the eye still closed, and any excess ointment is wiped away. Apply appropriate dressing if required.

Self-administration of eye medication

Self-care is essential if the patient is to instil drops at home on a long-term basis. The patient should be taught the procedure correctly and allowed to practise under supervision using normal saline eye drops. This will help to develop confidence and promote concordance with treatment. Self-care philosophy is vital in promoting a positive approach and will encourage the patient to adhere to the drug regimen.

Many patients may not realise that the loss of vision may have been caused by non-concordance, which is irreversible in most cases. Drop instillation and compliance with the treatment regimen are important when the individual believes the disorder to be serious (Rendell 2000).

Irrespective of whether the treatment is short term, as in bacterial conjunctivitis, or long term, as in primary open angle glaucoma, the individual should be informed of the benefits of taking his or her medication. Rendell (2000) discovered that this had an impact on the person's lifestyle and drop-using behaviour. Correct instillation of drops and the underlying reasons for it are a prerequisite for the preservation of sight in some ophthalmic disorders.

Conclusion

This article has discussed the role of the healthcare practitioner in the administration of eye medication with specific reference to the instillation of eye drops and the application of eye ointment. Administration of eye medication is a fundamental aspect of caring for patients with associated systemic or eye disorder.

Knowledge and understanding of the legal aspects of the practitioner's role are important since eye medications are legally controlled, and it is essential to avoid drug errors. Practitioners, therefore, should have a sound knowledge of the drugs being used and their implications for the treatment of eye disorders. This evidence-based knowledge is also important to allow the healthcare practitioner, as part of a multidisciplinary team, to deliver quality patient care and demonstrate safety and efficacy in practice as highlighted by the NMC (2004) guidelines. Patient involvement will help to ensure ongoing concordance with treatment and promote recovery **NS**

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