CET

COMPETENCIES COVERED

Dispensing opticians: Standards of Practice, Contact Lenses, Ocular Abnormalities
Contact Lens Opticians: Standards of Practice, Ocular Examination, Contact Lenses
Optometrists: Standards of Practice

Infection prevention and control in optical practice

Part 2

by Peter Black MBA FBDO FEAOO

The previous paper in this series covered the types of organism that can cause infection and how infection is transmitted between hosts. Part 2 covers the principal method of infection control in optical practice – decontamination.

PRACTICAL DECONTAMINATION

In order to understand how infection is controlled it is necessary to understand how it is transmitted, and how microbiological contamination can be ameliorated. After hand hygiene, regular decontamination of equipment and the practice environment is the most important step in infection prevention and control.

DECONTAMINATION TERMS

Clean: physically remove dirt. Cleaning is widely held to be the most important step in decontamination quite simply because the removal of spills, dust, dirt, grease and grime removes the nutrients that microorganisms feed on. This in itself stops them multiplying. Drying of surfaces and hands is also an important step in the cleaning process as most microorganisms cannot withstand dehydration but will thrive and multiply within the smallest drop of moisture.

Disinfect: kill the majority of microorganisms but not spores. Tap water is disinfected by the addition of chlorine, which kills all free-living microorganisms but is not effective against the spores of several microbes including species of acanthamoeba. Whilst they do no harm if ingested, they can cause devastating infection if they gain entry to the cornea. Preparations with disinfectant properties that are used in the cleaning or treatment of minor wounds (e.g. TCP, Germolene, Fusidic Acid) are usually termed antiseptic.

Sanitise: clean and disinfect, make healthful. Whatever the dictionary definition, this term is often used to refer to the hand gels used in healthcare environments to disinfect hands without necessarily cleaning. Anti-bacterial hand gels are best used in addition to washing, not instead of.

Pasteurise: disinfect (food, e.g. milk or utensils) by heating to 65°C to 80°C. This is a familiar way to kill food spoilage and food poisoning organisms in milk, fruit juice and other foodstuffs. Commercial food preparation demands the use of a 70°C dishwasher cycle for utensils, chopping boards, etc as well as the separation of equipment that is used for meat and fish from that used for cooked food and food served raw.

Sterilise: kill or remove all microorganisms and their spores by filtration (a common method for contact lens solutions), heat (e.g. autoclave, commonly used for contact lenses), irradiation (e.g. ultraviolet exposure) or chemical means (e.g. sodium hypochlorite) etc.

EXPONENTIAL GROWTH

In ideal conditions, bacteria such as the common gut bacteria *Escherichia coli* reproduce every 20 minutes. Since they reproduce by binary fission (cell division) they double in numbers three times every hour. So, a single bacterium could in theory be eight after one hour, 64 after two hours, and so on. A typical eight-hour overnight period could result in an eight million-fold increase in numbers. After 15 hours, there would be around eight billion times more bacteria than at the start.

Many people struggle to visualise the concept of large numbers and, while recognising that one billion is a thousand million, don't grasp the real magnitude. A good way to illustrate the scale of exponential growth is to compare a millionaire to a billionaire each spending their money at the rate of £1 per second. The millionaire would run out of cash after 11 days, 13 hours, 46 minutes and 40 seconds, whereas the billionaire could keep on spending at the rate of £1 per second for 31 years and 37 weeks.

Ultimately, exponential growth is only limited by the availability of food, water and competition from other organisms for available resources, or by the presence of some substance that prevents reproduction

This article has been approved for 1 CET point by the GOC. It is open to all FBDO members, and associate member optometrists. The multiple-choice questions (MCQs) for this month's CET are available **online only**, to comply with the GOC's Good Practice Guidance for this type of CET. Insert your answers to the six MCQs online at www.abdo.org.uk. After member login, go into the secure membership portal and CET Online will be found on the L menu. **Questions will be presented in random order.** Please ensure that your email address and GOC number are up-to-date. The pass mark is 60 per cent. The answers will appear in the October 2018 issue of Dispensing Optics. The closing date is 10 September 2018.

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Box 1: Handwashing

Handwashing is the single most important action any healthcare professional can take to prevent and control infection (Figure 1).

When should we wash our hands?

- *Always after going to the toilet or changing a baby's nappy*
- *Before eating or preparing food and immediately after handling raw meat*
- *After sneezing, coughing or blowing one's nose*
- *After touching animals*
- *Whenever hands are known to have become contaminated*
- *Before every patient (in front of them)*
- *Before handling contact lenses or instilling eye drops*

What instructions should be followed during handwashing?

The NHS in the UK offers simple guidance: Wet, soap, wash, rinse, dry:

- *Wet your hands with warm water (remove watch and jewellery)*
- *Soap and create a lather*
- *Wash your wrists, palms, backs of hands, each finger and thumb including nails*
- *Rinse thoroughly with warm water*
- *Dry thoroughly using disposable towels and use the towel to turn off the tap*

Hand sanitising gels may be used in addition and when washing is not possible.

or actively kills the organism. A method that prevents reproduction is known as bacteriostatic, whereas methods that kill bacteria are said to be bactericidal. Many antibiotics are bacteriostatic, affecting the target organism's ability to clone itself whilst giving the body's immune system time to rally its defences. Disinfectants and antiseptics will kill all known pathogenic micro-organisms in their free-living forms, however, many organisms have developed highly resistant spore forms that will withstand disinfection and desiccation which would normally kill most organisms.

HOW HYGIENIC IS YOUR PRACTICE?

On a practice visit to assess a trainee dispensing optician, the author witnessed a handover from the optometrist of a patient who needed new spectacles because the nose pad had been lost from her previous ones. The patient had an open sore, clearly suppurative and inflamed, where the pad arm had been digging in to the side of her nose. After dispensing, the author intervened to replace the nose-pad with a poorly matching one and advised the patient to clean the area with an antiseptic wipe and apply a sticking plaster to aid healing.

In discussion with the trainee and the optometrist supervisor later, both the trial frame and pupilometer were heavily contaminated with make-up and were not subject to regular infection control procedures. Neither practitioner had recognised the risk of giving the patient with an open sore a serious infection or indeed of passing an infection from this lady to a subsequent (perhaps immune-compromised) patient. Whilst most practices wipe down instrument chin rests, there is often little regard to trial frames, pupilometers or indeed stock frames that have been tried on by many patients.

Practitioners should adopt a high state of vigilance when knowingly dealing with immune compromised patients such as those living with cancer, diabetes, HIV/AIDS, or impaired liver or kidney function. There is a remote possibility of spreading Creutzfeldt-Jakob disease and HIV/AIDS via tears and it is therefore vital that disposable equipment or single use diagnostic agents are not reused. Reusable items such as contact tonometer prisms must be disinfected according to the manufacturer's instructions, typically with sodium hypochlorite solution such as Milton.

Figure 1: Hand hygiene is the most important aspect of infection control

WASTE DISPOSAL

Poor systems with regard to the disposal of general and food waste can encourage rodents, cockroaches, flies, etc, which dramatically increases the risk of human infection. Practices should also make special provision for the disposal of clinical waste including diagnostic drugs. In hospital practice, and increasingly in community practices that are involved in for example screening for diabetes, provision should also be made for the disposal of sharps.

INFECTION CONTROL IN CONTACT LENS PRACTICE

Contact lens opticians and optometrists have a duty of care to their patients to ensure that they do not unwittingly cause their patients to contract an eye infection. Handwashing (**Box 1 and 2**), discarding contact lens solutions at the appropriate

Box 2: Hand health

Repeated regular hand washing can be detrimental to health. Chapped cracked skin caused by a failure to dry the hands properly especially in cold conditions (e.g. after washing in cold water rather than warm) can lead to increased risk of skin infection.

Regular use of a hypoallergenic moisturiser will help to prevent such problems, however, care should be taken in contact lens practice not to contaminate lenses. Soap should be anti-bacterial and perfume free. Practitioners with sensitive skin should avoid soap or moisturisers preserved with Methylisothiazolinone[1].

time, using disposable diagnostic lenses where possible, and ensuring disinfection of reusable trial lenses are all important measures.

Perhaps more importantly, contact lens practitioners must also ensure their patients are aware of the risks of eye infection posed by contact lens wear and have sufficient information to make an informed choice with regard to the lenses they wear, how they wear them, and the lens care regimen they follow. A presentation from Moorfields Eye Hospital at 100% Optical in February 2015 stated that nine per cent of all ophthalmic Accident & Emergency (A&E) cases were contact lens-related keratitis (**Table 1**).

So, in 64 per cent of cases, infection could be a contributory factor in eye-related A&E cases. Even if most conjunctivitis and blepharitis/dry eye is not related to infection, this still leaves around one third of cases where infection is the prime cause, and around half of these cases (~15 per cent) are sight-threatening. As more and more contact lens opticians and optometrists become involved in minor eye conditions services (MECS) then their ability to manage, and appropriately refer these patients will be increasingly under scrutiny. In some places in the UK, it is already the case that patients with any of the above conditions must attend an accredited optical practice and not A&E.

With contact lenses implicated in the majority of sight-threatening infections, it is incumbent upon practitioners to consider how infection rates could be reduced by better education of patients. The US Centre for Disease Control and the UK Love Your Lenses offer contact lens wearers very similar advice[2,3]. However, it is interesting to compare the presentation – should infection control be separate from other wear and care advice to lend it more importance?

Practitioners have a duty to ensure they give their contact lens patients the following advice to minimise the risk of infection:

CONDITION	PERCENTAGE (%)
Blepharitis and dry eye	16
Conjunctivitis	13
Contact lens-related keratitis	9
Corneal abrasion, foreign body, recurrent erosion	7
Chalazion	7
Other keratitis	5
Pre-septal cellulitis	4
Uveitis	3
Orbital cellulitis	<0.5

Table 1: Ophthalmic A&E Cases at Moorfields Eye Hospital where infection is or may be a factor

- Wash your hands with soap and water. Dry them well with a clean cloth before touching your contact lenses every time.
- Don't sleep in your contact lenses unless prescribed by your contact lens practitioner.
- Keep water away from your contact lenses. Avoid showering in contact lenses, and remove them before using a hot tub or swimming.
- Rub and rinse your contact lenses with contact lens disinfecting solution – never water or saliva – to clean them each time you remove them. Daily disposables should be disposed of once worn.
- Never store your contact lenses in water.
- Replace your contact lenses as often as recommended by your contact lens practitioner.
- Rub and rinse your contact lens case with contact lens solution – never water – and then empty and dry with a clean tissue. Store upside down with the caps off after each use.
- Replace your contact lens case at least once every three months.
- Don't 'top off' solution. Use only fresh contact lens disinfecting solution in your case – never mix fresh solution with old or used solution.
- Dispose of solution at the directed time from opening or by the use-by date.
- Use only the contact lens solution recommended by your contact lens practitioner.
- Visit your contact lens practitioner yearly or as often as he or she recommends.

The above list shows conflicting information. For example, if a patient uses extended wear lenses is it realistic to expect them to remove their lenses for showering or swimming? **Loveyourlenses.com** tries to address this by urging patients to keep their eyes firmly shut in the shower and to wear watertight goggles when swimming. Patients need to be given the facts, relative risks and the danger signs to look out for so they don't put themselves at risk, or if an adverse incident does occur they act appropriately.

With new lens wearers, or experienced patients who are new to your practice, it is wise to assess their understanding of infection control and their compliance with instructions. Asking a patient to remove their own lenses prior to fluorescein instillation, and observing their inclination

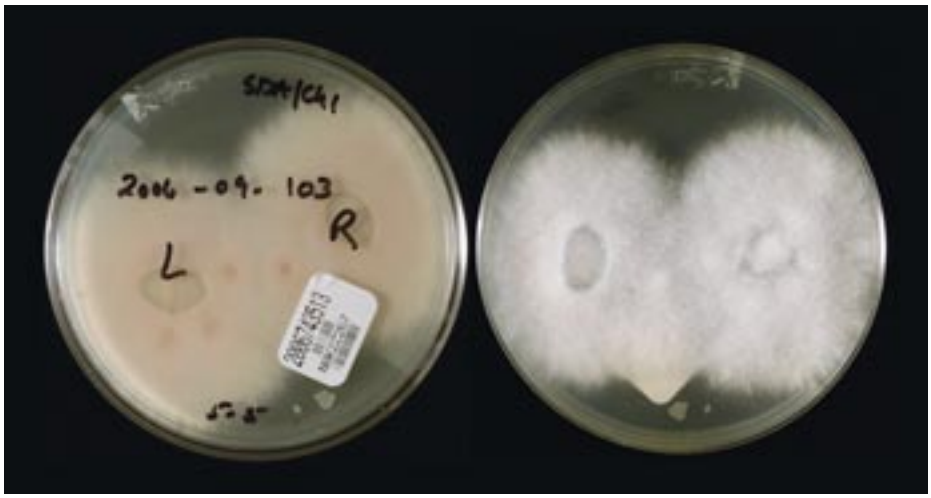

Figure 2: Fusarium oxysporum fungal organisms on contact lenses

to wash and dry their hands, is a good start. How practitioners communicate and ask questions is also important. For example, "Do you ever sleep in your lenses?" is likely to elicit a negative response, whereas "When did you last sleep in your lenses?" is likely to obtain a more truthful answer. Giving written information as well as verbal instruction is vital.

CONTACT LENS AFTERCARE PRODUCTS

Contact lens solutions are tested against a number of microorganisms that are known to cause eye infections. They usually include:

- Gram negative bacteria: *Pseudomonas aeruginosa; Serratia marcescens; Escherichia coli*
- Gram positive bacteria: *Staphylococcus aureus; Bacillus subtilis*
- Fungi: *Candida albicans; Fusarium solani*
- Protozoa: *Acanthamoeba castellanii*

Nonetheless, contact lens solutions have been implicated in worldwide epidemics of serious sight-threatening eye disease, notably *Fusarium* keratitis, on several occasions since the turn of the 21st century. Whilst this has partly been due to contamination of manufacturing facilities, it is also important to note that several manufacturers for a time did not advocate a rub and rinse step for their multipurpose solutions and, furthermore, some solutions are only tested against free living organisms in solution not against resistant biofilms such as are likely found on contact lenses and cases.

It is therefore important, even with very experienced long-standing contact lens wearers, not to assume that they are following their aftercare regimen correctly. In particular, the evidence has established that the rub and rinse step is vital to effective disinfection[4]. Patients who started wearing reusable lenses when 'no rub, no rinse' was the fashion, are likely to still be missing this important step in their aftercare regimen, so it is always worth finding out explicitly what steps the patient follows in cleaning and disinfecting their lenses.

Figure 2 shows either side of a Petri dish, which had been inoculated with the right and left contact lenses, visible on the culture medium, of a keratitis patient, and had subsequently grown a filamentous colony of *Fusarium oxysporum* fungal organisms (source: Public Health Image Library Centre for Disease Control).

ANTI-MICROBIAL MEDICINES FOR OPHTHALMIC USE

It is beyond the scope of this article to go into detail with regard to treatment for infectious eye disease, however, it is incumbent upon all practitioners to understand their own scope of practice, the likely course of treatment and possible side-effects and complications associated with eye infections – and in particular the incorrect use of antimicrobials.

Chloramphenicol is a bacteriostatic antibiotic produced by bacteria of the genus *Streptomyces* to help them compete against Gram negative bacteria, although in recent years many strains have evolved to develop resistance. UK registered dispensing opticians and optometrists can issue chloramphenicol (e.g. Optrex Infected Eyes) for acute bacterial conjunctivitis only, however, there is doubt as to its effectiveness.

Chloramphenicol should not be issued for microbial keratitis as there is no means of knowing which organisms have caused the infection. It is often thought that by eliminating less harmful species of bacteria, the indiscriminate use of antibiotic drops can create an environment where there is less competition for the most harmful organisms which can then thrive with much more sight-threatening potential consequences. The author has also witnessed practitioners incur the wrath of ophthalmologists when they have been unable to culture corneal swabs because of the use of chloramphenicol, which is perplexing as it would suggest the antibiotic had been effective. That said, the biology of microbial keratitis is complex and the evidence now shows that culturing swabs for 24 to 48 hours is an insufficient timescale for the growth of some organisms, particularly fungi.

The picture is further complicated by contact lens wear. Normally bacterial conjunctivitis is usually caused by Gram positive bacteria such as *Staph. aureus*, *Streptococcus pneumoniae*. However, in contact lens wearers, Gram negative bacteria dominate in conjunctivitis, such as *Haemophilus influenza*. Chloramphenicol is recommended as treatment in the UK for acute bacterial conjunctivitis because it is broad spectrum and effective, but generally bacterial conjunctivitis is self-limiting. Although the same bacteria cause keratitis, chloramphenicol isn't effective against the most devastating sight-threatening infections such as *P. aeruginosa*[5], and *Acanthamoeba*.

There is good reason it seems that the UK General Medical Practitioner's favourite ocular antimicrobial is Brolene (0.1 per cent propamidine isethionate drops, 0.15 per cent dibromopropamidine isethionate ointment). It is active against Gram positive, and some Gram negative bacteria, and has anti-fungal and anti-amoebic properties. Brolene eye drop formulations contain benzalkonium chloride as a preservative.

A NOTE ON PRESERVATIVES

Preservatives such as benzalkonium chloride can cause allergy and toxic reactions with long-term use. It is a good thing that they have been removed from many dry eye and glaucoma preparations but only where alternative protection from microbiological contamination is in place, such as unit dose vials or novel multi-dose bottles that maintain the sterility of the contents through the use of filtration membranes. Preservatives keep us safe from infection and are another weapon in our armoury that need to be balanced against risks of infection, patient non-compliance, allergy and cost of treatment.

CONCLUSIONS

If there is one take-home message from this article, it is that hand hygiene is the most important aspect of infection control. However, there is increasing evidence that

in cost-conscious times it is unfair to blame poor hand hygiene alone for the rise of healthcare acquired infection[6]. It is important to ensure that all items that come into direct contact with patients and practitioners – from door handles to chin rests – are regularly sanitised.

Eyecare practitioners must take extra care when dealing with patients who are likely to be immune compromised, especially when conducting invasive tests such as contact tonometry, as they are at a greatly increased risk of contracting ocular, respiratory, skin or gastrointestinal infection from normally harmless organisms.

Contact lens practitioners should recognise that their patients are at the greatest risk of serious sight-threatening eye infection. They should be apprised of these risks and given information in writing so that they can take mitigating action such as wearing their spectacles while they sip prosecco in the Jacuzzi.

Finally, practitioners are strongly advised to familiarise themselves with the detailed advice and guidance issued by their professional bodies.

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FURTHER READING

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PETER BLACK trained at Glasgow Caledonian University, winning the prize for best student before completing his pre-registration period with Conlons Opticians where he spent the next 25 years. He spent two years as dispensing standards manager for Boots Opticians and was a member of their Patient Safety Group. Peter is a practical examiner and past president of ABDO, Fellow of the European Academy of Optometry & Optics, and sits on the Registration Committee of the General Optical Council. In April 2018 Peter was appointed senior lecturer in ophthalmic dispensing at the University of Central Lancashire, Preston.