

Infection control guidelines for optometrists 2016^a

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Background: This paper provides an updated version of the paper: Infection control guidelines for optometrists 2007.

Methods: Information from peer-reviewed journal articles, guidelines from professional societies, and government health department and other websites and instructions from equipment manufacturers were considered in determining infection risk factors in optometric practice. They were used to revise the recommendations on disinfection, sterilisation and reprocessing procedures for instrumentation and other equipment used in optometric practice as well as personal infection control measures to be undertaken by staff.

Results and conclusions: Optometrists and optometric practice staff should adopt measures to minimise the risk of transmission of infection. These include appropriate hand-washing, staff vaccinations, single use instruments/equipment, appropriate disposal of waste, appropriate methods of reprocessing where items are reused, routine employment of standard infection control precautions and application of more rigorous procedures for individuals who are known to be infected or immuno-suppressed. Information provided to patients regarding infection control procedures in topical drug administration, contact lens wear and use of eye make-up are additional considerations for optometrists.

Key words: disinfection, infection, infection control, sterilisation, vaccination

Infection control guidelines for optometric practice in Australia were developed in 1986¹ and revised in 1995² and 2007.³ This paper provides a revised version of the 2007 paper.³

Optometrists and optometric practice managers must take reasonable precautions to minimise the risk of exposure to infection for patients and staff attending or working at their practice(s). This paper presents revised infection control guidelines aimed at providing information to assist in minimising the risk of transmission of infection in optometric practices. The scope of optometric practice continues to expand, particularly in the area of therapeutic prescribing and in March 2016, 48 per cent of optometrists in Australia were endorsed to prescribe scheduled medicines.⁴ Optometrists provide primary eye care and their distribution in urban and rural areas as well as city and metropolitan areas means that they may be the first point of contact for

people with infectious eye and other conditions. Optometrists often work with general medical practitioners, other primary health-care providers and specialists, such as ophthalmologists, in the management of patients. Regardless of whether the optometrist is or is not able to prescribe scheduled medicines, patients presenting to optometric practices may have infectious ocular conditions, so it is essential that optometrists are aware of and adhere to procedures to minimise the risk of transmission of infection in practice and are able to educate their patients in this area. In addition, patients and staff at optometric practices may have infectious systemic diseases or be carriers of infectious conditions. Adherence to infection control guidelines and to Australian local government, state and federal workplace health and safety requirements will assist in minimising the risk of transmission of infection.

In this revised document, some sections of the guidelines are relatively unaltered compared to the previous version, other sections have been expanded upon or

modified and new material has been added in some areas. Risk factors for infection in optometric practice and recommendations for infection control, including immunisations, hand hygiene, use of eye-drop bottles and single-dose vials and reprocessing of ophthalmic devices are addressed.

ELEMENTS NECESSARY FOR INFECTION

Three elements are necessary for infection: a source of infectious agent, a mode of transmission and a susceptible host.⁵ In optometric practice, patients and staff can be exposed to infectious agents from themselves (endogenous agents), other people, contaminated medications, instruments and equipment or from the environment (exogenous agents).⁵

The main modes of transmission of infectious agents in health-care settings are:^{5–13}

1. Direct or indirect contact (including blood-borne). In direct contact, the infectious agent is transferred from one person to another without a

^aThese guidelines are endorsed by Optometry Australia.

contaminated intermediate object or person, for example, when blood or other body substances from an infectious person come into contact with a mucous membrane or breaks in the skin of another person.

In indirect contact, the infectious agent is transferred through a contaminated intermediate object (fomite) or person, for example, contaminated hands of health-care workers. Examples include influenza (*Haemophilus influenzae*), conjunctivitis (*Haemophilus influenzae*), gastroenteritis (norovirus), antibiotic-associated diarrhoea (*Clostridium difficile*), highly contagious skin infections/infestations, such as impetigo and scabies (*Staphylococcus aureus* and *Streptococcus pyogenes*), epidemic keratoconjunctivitis (adenoviruses 8, 19, 37, 53 and 54) and microbial keratitis (*Acanthamoeba* spp.).

2. Droplets can be spread from coughing, sneezing and talking but also via hands, for example, influenza (*Haemophilus influenzae*), gastroenteritis (norovirus), meningococcal disease (*Neisseria meningitidis*) and epidemic keratoconjunctivitis (adenoviruses 8, 19, 37, 53 and 54).
3. Airborne small-particle aerosols are created during breathing, talking, coughing or sneezing or where there is evaporation of larger droplets in conditions of low humidity, for example, measles (rubeola) virus, chickenpox (varicella) virus, tuberculosis (*Mycobacterium tuberculosis*) and epidemic keratoconjunctivitis (adenoviruses 8, 19, 37, 53 and 54).
4. Other modes of transmission. These include contaminated water, medications, devices or equipment, food, insects or animals, for example, microbial keratitis (*Acanthamoeba* spp. via water) and toxoplasmosis (*Toxoplasma gondii* via contaminated meat).

Communicable diseases that could be encountered in optometric practice in Australia include human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS), hepatitis A, B and C, tuberculosis, measles, mumps, rubella, chicken pox, shingles, mononucleosis (glandular fever), genital herpes, influenza, impetigo (school sores), scabies, chlamydia, (infectious) conjunctivitis and keratoconjunctivitis and Creutzfeldt–Jakob disease.^{12–19} The Australian Government Department of Health maintains a current

list of communicable diseases with definitions and prevalence²⁰ and provides a quarterly email alert service.²¹

STANDARD AND TRANSMISSION-BASED PRECAUTIONS

It is impossible to be certain that staff and patients do not carry infectious agents, so a general approach to infection control must be instigated. ‘Standard precautions’ and ‘transmission-based precautions’ (the latter previously termed ‘additional precautions’) are terms used for appropriate infection control work practices for the care and treatment of patients.⁵

The precautions include work practices that aim to achieve a basic level of infection control, particularly in the handling of blood, other body fluids, secretions and excretions, non-intact skin and mucous membranes. Although there is no direct reference to optometric practice in the National Health and Medical Research Council (NHMRC) document,⁵ the standard precautions have application in optometric practice because of the possibility of contact with mucous membranes, tears and blood.³

Standard precautions relevant to the optometric practice are thus:⁵

1. hand hygiene
2. use of personal protective equipment
3. safe use and disposal of sharps
4. routine environmental cleaning
5. reprocessing of reusable medical equipment and instruments
6. respiratory hygiene and cough etiquette
7. aseptic non-touch technique and
8. waste management.

Transmission-based precautions are recommended in health-care settings for patients known or suspected of being infectious or colonised with disease agents that cause infections and which may not be contained with standard precautions alone. Optometrists may wish to ask all patients about their blood-borne virus carrier or infection status within the patient history or through a patient questionnaire prior to the patient examination. Transmission-based precautions should be applied when there is risk of airborne or droplet transmission of respiratory secretions or when there is inherent resistance to standard sterilisation procedures, for example, suspected variant Creutzfeldt–Jakob disease (vCJD).³

Transmission-based precautions relevant to the optometric practice are isolation of

infected patients, (for example, suspected adenoviral infection), patient dedicated equipment (for example, single-use tonometer probes) and enhanced cleaning and disinfecting of the patient environment (for example, additional cleaning of surfaces and equipment).

There are no universal guidelines that apply to the decontamination of ophthalmic instruments used by optometrists and thus, it is necessary to refer to the manufacturers’ guidelines or other health professions’ sources of information.³

RISK FACTORS IN OPTOMETRIC PRACTICE

Exposure-prone procedures (EPPs) (invasive procedures) are those where there is a potential for direct contact between the skin of the health-care worker and sharp surgical instruments, needles or sharp tissues (for example, fractured bones), spicules of bone or teeth in body cavities or in poorly visualised or confined body sites. EPPs are associated with an increased risk of transmitting blood-borne viruses between health-care workers and patients, hence, staff members with particular conditions should not perform certain EPPs because of the risk to the patient.⁵ The NHMRC has stated that the ‘training and practice of optometry does not require the performance of EPPs’.⁵

There are a number of instances in which optometrists may be exposed to blood, tears and mucous membranes or to infection in their practice:

1. removal of foreign bodies
2. assessment of patients who present with conditions that can be spread by droplet or aerosol (for example, influenza)
3. assessment of patients who vomit or who are incontinent (this includes young children)
4. assessment of patients with ocular trauma
5. assessment of patients with infectious conjunctivitis
6. assessment of patients with microbial keratitis
7. lacrimal lavage, removal of eyelashes
8. expressions of glands and cysts
9. contact lens fitting
10. epithelial debridement
11. post-operative management and
12. gonioscopy.

SPECIFIC CONDITIONS

Human immunodeficiency virus/ acquired immune deficiency syndrome

Human immunodeficiency virus has been isolated from tears, contact lenses, aqueous, vitreous and ocular tissues^{22–26} but there is no evidence of transmission through these. Infection requires direct contact between blood/body fluids and mucous membranes or damaged skin, for example, through (unprotected) sexual contact or through sharing needles and/or syringes with an infected person, through receiving blood transfusions, blood products or organ/tissue transplants that are contaminated with HIV. Injuries from needles containing HIV-infected blood or infected blood entering an open cut or a mucous membrane have also been reported as causing HIV infection.²⁷

Despite long-term highly active anti-retroviral therapy and no detectable plasma viral load, a sample of patients had detectable HIV-1 viral load in tears, suggesting that the lacrimal gland and other tissues associated with tears could be reservoirs for HIV-1 and emphasising the need for precautions in the performance of eye examinations, regardless of whether or not HIV infection has progressed to AIDS.²⁸ In 1984, HIV-1 was found to be the primary causative viral agent in AIDS and in 1986, HIV-2 was isolated from patients with AIDS in West Africa. Although the viruses have similar modes of transmission and are associated with similar opportunistic infections and AIDS, HIV-1 is potentially more contagious than HIV-2.²⁹

Hepatitis

Hepatitis B, C and D are transmitted by parenteral contact with infected body fluids, including blood, semen, saliva, sweat and tears; invasive medical procedures using contaminated equipment, and vertical transmission from mother to child. Hepatitis A, E and G are typically transmitted by ingestion of contaminated food or water.³⁰

One study found extremely high levels of hepatitis B DNA in tear specimens from young children with chronic hepatitis B.³¹ As the hepatitis B surface antigen may be present in the conjunctival fluid, there is a risk that it may be transferred to a tonometer or contact lenses.^{32,33}

Creutzfeldt–Jakob disease

The number of cases of CJD in Australia is extremely low (at 31 December 2013, 989 cases were included on the Australian National CJD Register with 757 of these being classified as probable or definite CJD cases);¹⁷ with global CJD incidence reported as one case per million population per year.¹⁷ There is no evidence that CJD is a significant risk in optometric practice and no evidence of CJD transmission by contact with intact skin. As there is lymphoid tissue in the cornea,³⁴ there is a theoretical possibility of transmission of vCJD and other forms of CJD between patients through optical devices that contact the eye, for example, trial contact lenses and tonometers. Such transmission is described as 'highly improbable'.³⁴ The NHMRC lists the cornea, limbus, eyelids, periorbital tissue, lacrimal system, conjunctiva, iris, crystalline lens, anterior vitreous (excluding the posterior hyaloid face), extra-ocular muscles, ciliary body, sclera (but not if allogeneic sclera used) and tissues of the orbit except the optic nerve as sites of low or no detectable infectivity.³⁵ Instruments having contact with only these tissues and fluids may be processed as normal.³⁵ The posterior hyaloid face, retina, retinal pigment epithelium, choroid, subretinal fluid and optic nerve are classified as medium or high infectivity.³⁵

Use of single-use instruments should be considered in patients known to be at high risk of transmitting CJD. These patients usually report neurological symptoms and display neurological signs of the disease. There have been reports of one case and one probable case of CJD following keratoplasty.³⁵

Adenoviruses

Adenoviruses are highly contagious and depending on the serotype, can survive outside the host for up to three months, even on dry surfaces.^{36,37} Adenoviruses account for 10 per cent of childhood upper respiratory tract infections. Conjunctivitis may occur in conjunction with pharyngoconjunctival fever, caused predominantly by serotypes 3, 4 and 7, with transmission often through swimming in contaminated water. Usually the respiratory tract symptoms precede the ocular symptoms. The incubation period is five days and the conjunctivitis usually affects one eye and spreads to the fellow eye and the condition lasts for five to seven days. Epidemic keratoconjunctivitis is caused predominantly by serotypes 8, 19 and 37.

This is highly contagious, with 10 per cent of cases transmitted within the family. Transmission is associated with instrumentation, airborne particles, contaminated ophthalmic solutions and via the hands of health-care professionals.³⁸ After a seven- to 10-day incubation period, a unilateral red eye develops, spreading to involve both eyes, frequently with corneal involvement.

Chlamydia

The intracellular bacterium *Chlamydia trachomatis* causes trachoma, an infectious conjunctivitis in children and caregivers. Repeated infections give rise to trichiasis and corneal blindness in adults. The SAFE strategy is a World Health Organization (WHO) endorsed program for the prevention of blinding trachoma, involving Surgery to prevent corneal blindness, Antibiotics, such as azithromycin to treat active conjunctivitis, Facial cleanliness and Environmental modification.³⁹ The organisms are transmitted by:

1. direct contact, for example, touching infected eye, nasal or throat secretions
2. indirect contact, for example, touching contaminated items, such as towels, sheets, blankets or clothing and
3. flies that seek out the eyes.⁴⁰

Chlamydia trachomatis also causes chlamydia, the most common sexually transmitted infection in Australia, which can result in adult inclusion or chlamydial conjunctivitis, which may be chronic and contagious. Pregnant women can pass chlamydia on to their babies, causing serious ocular infections.⁴¹ Adults with inclusion conjunctivitis should avoid sharing towels, linen or make-up, avoid the workplace or crowds, regularly wash their hands, limit physical contact, inform their health-care providers and be aware of preventative measures and precautions for sexually transmitted diseases. Patients should be referred for treatment.

DISINFECTION, STERILISATION AND REPROCESSING

Several terms are used to describe infection control procedures. Optometrists should be familiar with these.

'Cleaning' is the removal of foreign material (for example, organic material) from objects using water and a detergent solution or enzymes (usually proteases).⁵ Cleaning is the first stage in reprocessing, as an instrument cannot be disinfected or sterilised unless it is clean. The cleaning

solution and method of cleaning must be appropriate for each instrument and piece of equipment. Instruments should be inspected (with magnification where possible) and be visibly clean.

'Disinfection' is a process that inactivates non-spore forming infectious agents, using either thermal (moist or dry heat) or chemical means. Items need to be cleaned before being disinfected.⁵

'Sterilisation' destroys all microorganisms on the surface of an instrument. Sterilisation is usually achieved through reprocessing of heat-resistant items using steam, although low-temperature sterilisation technology (chemical) is available for reprocessing heat and moisture-sensitive items.⁵

'Reprocessing' is the process of cleaning, disinfection and/or sterilisation of a device that is to be reused.⁵

A 'hygienic' state is a state conducive to maintaining health and preventing disease, especially by being clean or sanitary.⁴²

'Sanitary conditions' are clean and not dangerous for health, or protect health by removing dirt and waste, especially human waste.⁴³

Levels of disinfection according to type of microorganism are shown in Appendix 1.

RECOMMENDATIONS FOR OPTOMETRIC PRACTICE

Identification and management of staff and patients with infectious diseases

Optometrists and staff with infectious diseases need to be aware of the precautions to take to avoid the transmission of disease when dealing with patients. As well, they need to know the conditions that should exclude them from attending work (examples include influenza, gastroenteritis and conjunctivitis) and at what stage they can return to work. Exclusion periods for health-care workers with infectious illnesses are detailed in the NHMRC Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010);⁵ for example, staff with conjunctivitis must not provide patient care while there is discharge. In the unlikely event that a staff member in an optometric practice were to undertake EPPs, the staff member must meet NHMRC guidelines regarding blood-borne viruses, such as hepatitis B virus,

hepatitis C virus and HIV. These requirements include not performing EPPs, if they are:

1. HIV antibody positive
2. hepatitis B e antigen (HBeAg) positive and/or hepatitis B DNA positive at high titres and
3. hepatitis C RNA positive (by nucleic acid test).

If a staff member carries a blood-borne virus not listed above or has test results that indicate the potential to infect a patient with hepatitis, specialist medical advice must be sought before they perform EPPs.

Optometrists should ask patients presenting at the practice to provide information about their general health in a registration form or as part of their case history and as part of this general health assessment may ask whether patients have any infectious or transmissible diseases. As patients may not always be prepared to divulge information about certain infectious conditions, it should not be presumed that a negative reported history equates with an actual negative history and consideration of risk factors, such as intravenous drug use, is important.

Patients with short-term infectious illnesses such as colds and influenza should be asked to reschedule their appointment if their eye examination is not urgent.

Practice staff who greet patients in the practice and staff who undertake pretesting of patients should be advised to seek the advice of the optometrist for any patients presenting with a 'red eye' or ocular discharge before this testing is undertaken.

Immunisation for optometrists

The vaccinations that are recommended for all health-care workers in Australia are:⁴⁴

1. hepatitis B
2. influenza (yearly)
3. pertussis (dTpa) (diphtheria, tetanus and whooping cough)
4. varicella (chicken pox) (if non-immune) and
5. MMR (measles, mumps, rubella) (if non-immune), (all adults born during or since 1966 should have evidence of either receiving two doses of MMR vaccine or having immunity to measles, mumps and rubella. Those born before 1966 are considered to be immune due to extensive measles, mumps and rubella then circulating widely in the community.)

Health-care workers who work in remote Indigenous communities or with Indigenous children in NT, QLD, SA and WA should also receive hepatitis A vaccination.

Health-care workers who may be at high risk of exposure to drug-resistant cases of tuberculosis (dependent on state or territory guidelines) should also have BCG (bacille Calmette-Guérin) vaccination.⁴⁴

In addition to the vaccinations above, optometrists who see institutionalised patients, including patients in nursing homes, should also consider being immunised against hepatitis A. (There is currently no vaccination against hepatitis C).⁴⁵

Immunisation for practice staff

It may be valuable to offer non-optometric staff immunisations against influenza each year, both to avoid lost time through illness and to lessen the risk of passing on the virus to other staff and patients. For practice staff directly involved in patient care, the vaccinations listed for optometrists are more appropriate.

Hand washing

Any infectious agent transmitted by the contact or droplet route can potentially be transmitted by touch.⁵ The hands of health-care workers have been described as the most common vehicle for transmission of health-care-associated pathogens from patient to patient in the health-care environment.⁴⁶ Hand washing is considered to be the most important measure in preventing the spread of infection in the health-care setting.^{5,46} Hand hygiene must be used as part of a multifactorial approach to prevent and control infection.⁵

The aim of hand washing is to remove transient biota colonising the superficial layers of the skin; these biota are most frequently associated with health-care-associated infections. Usually, resident biota are attached to deeper layers of the skin and are more resistant to removal but are less likely to cause infection.⁴⁷

Hand washing must be performed before and after significant contact with any patient and after activities likely to cause contamination, for example, eating or handling food, emptying waste paper baskets, going to the toilet, blowing/wiping/touching one's nose and mouth⁵ and after coughing and sneezing.⁴⁸ Hand washing should also be performed after the removal of gloves and after possible/real bloody/

body substance contamination.⁵ When seeing patients, optometrists must avoid touching their own face, nose, mouth and eyes.

The effectiveness of hand-hygiene procedures is decreased when a person has cuts and abrasions (as intact skin is a natural defence against infection).⁵ Cuts and abrasions should be covered with water-resistant occlusive dressings or surgical gloves should be used.

A 2012 Cochrane review⁴⁹ found no trials investigating whether wearing nail polish or finger rings affected the rate of surgical wound infection and there was insufficient evidence to determine whether wearing nail polish affects the number of bacteria on the skin post-scrub. There has been research indicating an association between wearing rings and higher median skin organism counts; contamination with *Staphylococcus aureus*, Gram-negative bacilli or *Candida* species and a stepwise increased risk of contamination with any transient organism as the number of rings worn increased.⁵⁰ Artificial fingernails can impede appropriate hand hygiene.⁵¹

The NHMRC guidelines recommend that fingernails are kept clean and short, that artificial nails are not worn and that if nail polish is used, it should not be chipped and should be removed every four days.⁵

A 'Bare Below the Elbows' policy has been recommended by the National Clinical Guideline Centre in the UK for all health-care workers. The policy includes avoidance of long sleeves, removal of wrist and hand jewellery, short clean fingernails that are free of nail polish and covering of cuts and abrasions with waterproof dressings.⁵² This is a significant step and may not be necessary or appropriate for optometry.

White coats, long sleeves and items of clothing that are not regularly laundered such as jumpers, suit jackets, ties and so on, have the potential to be routes for patient-to-patient transmission of pathogens such as *Staphylococcus aureus* (including methicillin-resistant *Staphylococcus aureus*).^{53,54}

Hand-basins should be fitted in all consulting rooms and in locations where contact lenses may be inserted or removed. Hand-basins must be kept clean. Elbow or foot controls for taps or sensor-controlled taps are recommended to regulate the flow of water.

PRODUCTS FOR HAND HYGIENE

It is difficult to compare studies of suitability of products for hand hygiene due to

differences in methods and study design. Products for hand hygiene in order from most to least effective are alcohol formulations, chlorhexidine, iodophors, triclosan, plain soap.^{55,56} Other factors influence the suitability of products, for example, the drying effects of alcohol-based soaps limit frequent use, use of moisturising soap and in the case of hand sanitisers the amount of dirt on the skin prior to application. Further information about products for hand hygiene is available on the WHO website and the Centers for Disease Control and Prevention (CDC) website.^{47,51}

Hand-care products, such as plain (non-antimicrobial) soap and antiseptic products, can become contaminated. Storage and dispensing of products should be according to manufacturer's instructions. To avoid contamination, closed containers should be used to store liquid products, which should then be dispensed from either disposable containers or containers that have been washed and dried thoroughly before being refilled. Partially empty dispensers should not be topped up as this may lead to contamination.⁵⁵

Plain (non-antimicrobial) soap

Plain (non-antimicrobial) soap in any of its forms (bar soap, tissue, leaflet or liquid) is not recommended for use by health-care workers, as it has minimal antimicrobial activity (although it can remove loosely adherent transient bacteria).⁵⁶ Bar and liquid soaps can become contaminated with bacteria during use.⁵⁷ Contamination of liquid soap with Gram-negative bacteria in a health-care setting has led to hand-borne transmission of the bacteria.⁵⁸

Alcohol-based antiseptics

Alcohol is used in hand rubs, hand gels and foams.⁵⁹ Alcohol-based cleaners or sanitisers are the first choice at point of care and as alternatives to hand washing, where there are no hand-washing facilities. There is no evidence to support hand washing followed by sanitiser use. Alcohol-based cleaners or sanitisers are more effective for hand washing than soap or antimicrobial soaps but are not effective when hands are visibly dirty or contaminated with proteinaceous materials, such as blood.⁵⁶

Alcohol-based hand antiseptics contain isopropanol, ethanol, n-propanol or a combination of two agents; they denature proteins and are effective against Gram-

positive and Gram-negative bacteria, mycobacteria, fungi, enveloped viruses (herpes simplex virus [HSV], HIV, influenza), hepatitis B (less susceptible) and hepatitis C.⁵⁶ They are not effective against bacterial spores, protozoan cysts (for example, *Acanthamoeba*) and certain non-enveloped viruses.⁵⁶

Although both alcohol-based hand rinses and gels decrease bacterial counts on hands, alcohol-based hand rinses have been shown to be more effective than alcohol-based hand gels.⁶⁰

Chlorhexidine

Preparations using four per cent chlorhexidine are more effective than preparations using lower concentrations.⁵⁶ Chlorhexidine rapidly reduces both skin flora and transient bacteria and has residual activity on the skin^{61,62} that helps to prevent rapid regrowth of skin organisms and lengthens the duration of skin antiseptics.⁶¹ The most frequent adverse reaction to chlorhexidine is contact dermatitis but rare cases of hypersensitivity and anaphylaxis have been reported.⁶¹ Infection rates have been reported as being lower after antiseptic hand washing using chlorhexidine than after hand washing with plain soap or alcohol-based hand rinse.⁶³ The most commonly used agent for the different procedures of hand hygiene (social, antiseptic and surgical hand-wash) is chlorhexidine, usually at a concentration of four or two per cent.⁶⁴ Chlorhexidine is also used in hand rubs.

Other products

Iodine and iodophors have good bactericidal activity but iodine often causes irritation and allergic reactions, while iodophors cause more irritant contact dermatitis than other antiseptics for hand hygiene.⁵⁶ Quaternary ammonium compounds, such as benzalkonium chloride, are primarily bacteriostatic and fungistatic and their efficacy is affected by the presence of organic material.⁵⁶ Triclosan (found in antibacterial hand-wash for home use) is often only bacteriostatic and has poor activity against Gram-negative bacteria.⁵⁶

CHOICE OF HAND-CLEANING METHOD

Alcohol-based hand rubs are now the gold standard of care for hand hygiene in health-care settings, with hand washing

using soap and water reserved for when hands are visibly soiled or if there has been exposure through non-use of gloves to *Clostridium difficile* or non-enveloped viruses, such as norovirus.^{65,66} Suitable alcohol-based hand rubs contain 60 to 80 per cent v/v ethanol or equivalent and meet the requirements of European Standard EN 1500 (hygienic hand rub).⁶⁶

Hand rubs are unsuitable for use in contact lens practice because of the possibility that residual debris and bacterial toxins on the hands and chemicals from the hand rub may be transferred to the lens prior to insertion in the patient's eye. All optometrists fitting contact lenses should ensure that they have access to proper hand-washing facilities.

A table to assist practitioners in the selection of appropriate hand-cleaning products is available on page 45 of the CDC Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices.⁵⁶

It should be noted that although hand hygiene with soap and water and three alcohol-based hand rubs was highly effective in reducing influenza A virus on human hands, the soap and water intervention was the most effective.⁶⁷ Hand washing with soap and water is much more efficient for removing rhinoviruses (a cause of the common cold) from skin than rubbing hands with an ethanol-containing disinfectant.⁶⁸

Recommended procedures for hand washing are outlined in Appendix 2.^{63,69,70} Posters showing appropriate hand-washing and hand-rubbing techniques are available in the WHO Guidelines on Hand Hygiene in Health Care.⁵¹

Personal protective equipment

'Personal protective equipment (PPE) refers to a variety of barriers, used alone or in combination, to protect mucous membranes, airways, skin and clothing from contact with infectious agents.⁵ In optometric practice the PPE items most likely to be needed are gloves, masks, protective eyewear and face shields.

'The mucous membranes of the mouth, nose and eyes are portals of entry for infectious agents, as are other skin surfaces, if skin integrity is compromised (for example, by acne, dermatitis).⁵

Powder-free surgical gloves should be available for use in all practices. These are available as sterile or non-sterile. Gloves should be worn when there is a possibility of contamination with blood or body fluid (for example, where either the patient or the optometrist has open wounds) or when optometrists or their staff are in contact with high-risk patients (for example, those with serious communicable diseases, such as hepatitis B or active herpetic lesions).⁵⁶ Optometrists should frequently check their hands for cuts or abrasions. Gloves do not replace hand washing; hands should be washed before and after using gloves. Although broken skin may be detected through stinging when the hands are wiped with an alcohol swab, there is the possibility of contact dermatitis developing from alcohol swab use.⁷¹

Latex gloves are not suitable for all optometrists and patients and latex-free nitrile gloves are available as an alternative. Latex allergy has been reported to occur in 4.3 per cent of health-care workers and in 1.4 per cent of the population.⁷² Optometrists intending to wear latex gloves during a patient examination must ask the patient if they are allergic to latex prior to conducting any procedures involving direct contact. Gloves are also recommended when contact with cleaning solutions, such as glutaraldehyde or sodium hypochlorite, cannot be avoided.

An alternative to the use of gloves where there are concerns about touching potentially infected surfaces is the use of finger cots (which may be sterile or non-sterile) or no touch techniques using cotton-tipped applicators.⁷³

Finger cots are designed to protect fingers while injuries are healing and can be nitrile or powder-free latex. A finger cot looks like a single finger from a rubber glove. Finger cots must be discarded after use. Care should be taken when they are being removed from the packet. Finger cots are available in Australia.

Face shields or masks worn with safety glasses should be used during procedures where there is potential for splashing/splattering or spraying of blood or body fluids or the potential for airborne infection.⁵

Surgical masks should be used, if either the optometrist or the patient has a cold or influenza. Surgical masks should be removed and discarded if they become soiled or wet. Once removed, masks should not be reapplied. The front of the surgical mask should not be touched during wear and appropriate

hand hygiene should be performed after touching/discarding a used mask.⁵

Enclosed footwear should be worn to protect from injury/contact with sharps, such as needles used for foreign body removal.

Cleaning after spills of body fluids

Unlikely in optometric practice but more likely in residential facilities, is the possibility that there could be a patient who vomits or is incontinent. Thus, procedures should be in place to manage body fluid spills (for example, blood, urine, faeces, vomitus). Processes to clean up spills are detailed in section B1.4.3 (page 73) of the Australian Guidelines for the Prevention and Control of Infection in Healthcare.⁵

Instrumentation in optometric practice

Single-use instruments and equipment should be used whenever possible in optometric practice but there are several items in optometric practice that are reused. All reusable instruments need to be cleaned immediately after use and then disinfected or sterilised, depending on intended use. Guidelines for disinfection or sterilisation of devices, instruments and equipment are discussed below and summarised in Appendix 2.

REPROCESSING OF OPHTHALMIC DEVICES

Device classifications help guide practitioners to select the appropriate method of reprocessing for devices. The CDC,⁷⁴ US Food and Drug Administration (FDA)⁷⁵ and the Australian Government Department of Health and Ageing⁷⁶ describe different levels of risks for reusable devices: critical, semi-critical and non-critical. Examples of devices used in optometric practice are shown in Table 1.

Contact lenses

Ideally trial contact lenses should be used only once. If it is necessary to use trial lenses on a number of patients, in-practice disinfection procedures must be effective against bacteria, viruses (adenovirus, hepatitis, HIV), fungi and *Acanthamoeba*. In addition, optometrists must comply with contact lens manufacturers' information regarding the number of times that a lens can be reused and the maximum time after

Level of risk	Application	Process	Example
Critical: High risk for infection if contaminated with any microorganism	Entry/penetration into sterile tissue, cavity or bloodstream	All items must be sterile, for example, steam under pressure, chemical sterilants.	Needles, scalpels. Note: needles used in optometric practice for procedures such as foreign body removal MUST be single use
Semi-critical	Contact with intact mucosa or non-intact skin	Items should be sterile or there must be a minimum of high-level disinfection – preferably steam sterilisation or thermal disinfection (or high-level chemical if heat not tolerated).	Tonometer probes, contact lenses, gonioscopy lenses, lacrimal cannulae, pachymeters
Non-critical	Contact with intact skin	Items must be clean or undergo low/intermediate level disinfection	Blood pressure cuffs, stethoscopes, head and chin rests, phoropters, epilation forceps, trial frames

Note: items must be cleaned before disinfection or sterilisation.

Table 1. Levels of reprocessing of medical devices⁷⁴

its first use that a lens can be reused; lenses must also be inspected within this time frame to ensure that they remain suitable for use.^{77,78}

There is a theoretical risk of transmission of HIV via trial contact lenses but there have been no reported cases. All trial contact lenses used in patients who are carriers (or identified as potential carriers) of infectious diseases (for example, CJD, HSV, hepatitis, HIV or adenovirus) must be disposed of immediately after use.

Because not all patients will know or reveal that they are carriers of infectious diseases, optometrists must apply rigid infection control measures when they reuse contact lenses, for example, trial lenses.

All multi-use contact lenses should be cleaned and rinsed immediately after use to remove cellular and proteinaceous material, then disinfected to eliminate microorganisms. Multi-use contact lenses should be cleaned and rinsed again immediately prior to use and patients should be warned of the risks of reused lenses prior to fitting. (The optometrist may consider obtaining the patient's signature on a form acknowledging relevant risks and benefits associated with contact lens fitting.) In addition, soft contact lenses that cannot be heat-treated are not suitable for use as trial lenses and should be discarded after use.

Trial lenses should only be used in the optometrist's premises and should be under the control of the optometrist at all times.

Soft contact lenses

Cleaning procedures for soft contact lenses (based on International Organization for

Standardization [ISO] instructions for cleaning soft contact lenses⁷⁷) are included in Appendix 2.

Additional notes regarding soft contact lenses:

1. Despite its efficacy, three per cent hydrogen peroxide is not recommended, as contact lens parameter changes may occur with prolonged storage in peroxide.⁷⁹ In addition, lenses cannot be stored for longer than 24 hours in the neutralised peroxide solution⁸⁰ and transfer to a new storage solution carries the risk of recontamination.
2. Chemically preserved disinfectants are not suitable, as they have unknown efficacy against viruses and are questionable at limiting biofilm formation and fungal growth.
3. Practitioners should take care to avoid cutting themselves when removing metal seals on contact lens containers.

Gas-permeable contact lenses

Cleaning procedures for gas-permeable contact lenses are shown in Appendix 2.^{77,78,81}

Hard (polymethyl methacrylate [PMMA]) trial lenses may undergo heat disinfection, unlike rigid gas-permeable (RGP) lenses which may warp.^{73,82}

Recording of contact lens use and processing⁷⁷

Optometrists should maintain a record of processing of contact lenses that logs:

1. the patient reference
2. the date of use

3. the date and method of hygienic management
4. the contact lens details and
5. a note to indicate when it is time to disinfect trial lenses again (this should occur monthly).

Tonometers

As tonometer probes are the most common item in the consulting room to regularly come into contact with mucous membranes and tears of patients, optometrists must ensure that they are appropriately cleaned and maintained. Tonometer probes should be cleaned before and after use.

Haag-Streit reusable prisms have a shelf life of five years but should only be used for a maximum of two years and should be regularly checked.⁸³

In the literature,⁸⁴ there is controversy about the most suitable method to disinfect tonometers. Common practice is to wash the tonometer prism, wipe with an alcohol swab and allow to air dry. In a trial comparing a number of methods of disinfection, the greatest reduction in hepatitis C virus RNA occurred following a five-minute soak in three per cent hydrogen peroxide or 70 per cent alcohol, followed by washing in cold water (0.07 and 0.02 per cent of the virus RNA remaining, respectively) compared to 88.91 per cent remaining after isopropyl alcohol five-second wipes.⁸⁵ The hepatitis B virus is not consistently removed with alcohol wipes and one study showed that only rinsing with soap and water was effective in removing viral DNA. The authors of that paper recommend that

when an alcohol wipe is used, a soap and water rinse is performed before use of the wipe.⁸⁶ The most recent American Academy of Ophthalmology recommendations include ‘The CDC suggests that tonometer tips be wiped clean and then disinfected by immersing for 5–10 minutes in either 5,000 ppm chlorine or 70% ethyl alcohol. Then, after disinfection, the tonometer should be thoroughly rinsed in tap water and air dried before use’.⁸⁷ HIV and HSV types 1 and 2 were totally eliminated with a 70 per cent alcohol wipe or a wipe with sterile gauze soaked with three per cent hydrogen peroxide.⁸⁸ Adenovirus 8 (a common cause of epidemic keratoconjunctivitis)⁸⁹ was removed with alcohol, iodophor or hydrogen peroxide wipe or a five-minute soak in these disinfectants or bleach.⁹⁰ Alcohol swabbing and long-term (four days) continuous soaking with alcohol have been reported to cause damage to tonometer prisms, such as surface scratching and dissolving of the glue holding the tonometer prism together.^{91,92} Because of the varying information around tonometer disinfection methods, we recommend that practitioners refer to the manufacturer for information about the specific instrument.

Additional recommendations

1. Although CJD and vCJD are not major risks in Australia, optometrists should be aware that infectious prions are highly resistant to inactivation by many current disinfection techniques, such as alcohol and chlorhexidine (for CJD and vCJD) and autoclaving (for vCJD).⁹³ If the optometrist believes that there is a possibility that a patient is at risk of having CJD, non-contact tonometry or disposable tonometer tips/shields/prisms/probes should be used and disposed of immediately.
2. Use a disposable tonometer tip/shield/prism/probe or non-contact tonometry in cases of infection or if the patient has HIV.
3. If soaking prisms, have at least two prisms available for use so that one can be soaking while the other is being used.
4. If the user has had to remove the tonometer prism from the disinfecting solution by placing fingers into the solution, the solution should be changed each time this occurs. Any device used

for soaking tonometer tips must be cleaned with soap and water each day.

5. Non-contact tonometry may result in splash-back and as the tonometer could contact the eye, it is necessary to wipe it with an alcohol swab between patients.
6. If a tonopen is used, the tip must be covered with a disposable latex cover that is discarded after use. Obviously, latex tips must not be used for patients with latex allergies. Tips of pneumotonometers should be cleaned before and after measurements with 70 per cent isopropyl alcohol, taking care that the surface is dry before contact with the cornea. (Instructions regarding the cleaning, disinfection, use and maintenance of tonopens, pneumotonometers and a User’s Guide to Ocu-Film⁺ Tip Covers are available at www.reichert.com).
7. If tonometry is not performed, record the reason and whether the patient has been referred to another eye-care practitioner to have it performed.

Gonioscopy lenses

Disinfection of Haag-Streit gonioscopy lenses (contact glasses) should generally follow the tonometry guidelines. Optometrists should also consider the manufacturer’s instructions, for example, the recommendations by the manufacturers of the Volk Gonioscopy lens.⁹⁴ A cleaning process for gonioscopy lenses is included in Appendix 2.

Following disinfection, store the lens in a closed case or container. Any device used for soaking lenses must be cleaned with soap and water before and after use.

Fundus lenses

The procedure for disinfecting fundus lenses that contact the eye is the same as for gonioscopy lenses (Appendix 2). Fundus lenses that do not come in contact with the eye should be cleaned with mild detergent and water and air dried or dried with a lint-free cloth. If infection is suspected, the lenses should be disinfected, according to the manufacturer’s instructions, for example, the manufacturers of Volk Fundus lenses recommend the same process as for their gonioscopy lenses (Appendix 2). Disposable gonioscopy and fundus lenses are available and may be useful to consider in certain situations.

Other instrumentation

Other considerations include procedures for cleaning instrumentation for dilation and irrigation, forceps for eyelash epilation, foreign body removal, rust ring removal, Mastrotta paddle for meibomian gland expression and lid retractors (Appendix 2).

Eyedrop bottles and single-dose vials

External rims of bottles (for example, anaesthetic, mydriatic, in-practice contact lens solutions and saline bottles) may become contaminated. Optometrists should.^{95,96}

1. Check that the product has not reached its expiry date.
2. Store the unopened product within the temperature range recommended by the manufacturer. (Check whether storage temperatures are different for the opened and the unopened product.)
3. Mark the opening date on the bottle.
4. While using the bottle ensure that the bottle cap is held in the hand without touching the inside of the cap.
5. Ensure the bottle tip never touches the patient’s eyes, lids, lashes or the optometrist’s hands. If this occurs, discard the bottle.
6. Replace the bottle cap immediately after use.
7. Refrigerate the opened product, if appropriate (note: not all eye-drops can be refrigerated after opening; it is recommended that food is not kept in refrigerators where drugs are kept).
8. Store the product for the time after opening recommended by the manufacturer. Discard at the end of this time (usually one month after opening) or by the product’s expiry date, if this is earlier.
9. Use single-dose products whenever possible; if the eyes are infected, use only single-dose products. If it is not possible to use a unit dose container for an infected eye, discard the multi-use bottle after use.⁹⁵ Alternatively, use a sterile glass rod or disposable dropper to administer the drops. The glass rod may be disinfected by autoclaving.

Other considerations

Control of infection includes effective and regular cleaning of the practice premises, insertion of plastic liners in waste baskets, disposal of waste and elimination of insects

and vermin within the premises. There should be regular cleaning of all surfaces and fittings. Isopropyl alcohol tissues, 30 per cent alcohol solution or sodium hypochlorite solution (one per cent solution can be obtained by a 1:5 dilution of five per cent household bleach) may be used for large surface swabbing, although some surfaces may be damaged by alcohol. The practice should have a well-equipped first-aid kit and cardiopulmonary resuscitation masks.

WASTE DISPOSAL

Potentially infectious material (including disposable tonometry probes) must be disposed of as biohazardous waste. Material is to be placed in yellow containers or plastic bags, which are marked with black biological hazard symbols. To avoid needle-stick injury, needles should not be resheathed or removed from disposable syringes.

'Sharps' must be discarded in clearly labelled, puncture-proof containers.⁵ Collection of 'sharps' and potentially infectious waste can be organised through a collection service or arrangements made with a local general medical practitioner or pharmacist. Local councils may also be able to swap 'sharps' containers at no charge.

DAILY CONSULTING ROOM HYGIENE

There are several necessary daily activities:

1. Clean bench tops with a regular household detergent and water.
2. Clean the sink with household detergent and water, then dry with a disposable towel.
3. Put covers on equipment (for example, slitlamp).
4. Remove all visible soil and dirt from floors and walls (damp mopping is recommended where possible).
5. Computer keyboards and mice in health-care settings may become contaminated with potentially harmful microorganisms.⁹⁷ It is important that when clinical information is entered via computer in the consulting room that optometrists wash their hands before entering data and that computer keyboards and mice are wiped with alcohol each day or more frequently, if visibly soiled.⁹⁸ Keyboard/mouse covers can be used and are easily

removed and disinfected with a low or intermediate-level hospital-approved disinfectant. Washable/sealed keyboards may be employed. Keyboards can be as easily disinfected with or without covers using five seconds of friction and a wide range of low-level disinfectant solutions.⁹⁸

6. The possibility of microorganism contamination of portable electronic devices (for example, mobile phones, tablets and so on) used in the practice should be considered by optometrists, when using such devices.⁹⁹ Hands should be washed before using these devices after touching the patient or eating food and so on. Although there have been suggestions to use alcohol wipes, such use negates manufacturers' warranties.¹⁰⁰

PATIENT EDUCATION REGARDING INFECTION CONTROL

Issues regarding infection control do not stop when the patient leaves the practice. Patient education is required in a number of areas including:

1. appropriate use, storage, disposal of prescribed eye drops and ointments
2. precautions to minimise spreading any infections to the fellow eye or to other people (for example, not sharing eye drops, contact lenses, towels)
3. appropriate use, storage, cleaning of contact lenses and contact lens cases
4. disposal of eye make-up, if contaminated or meets expiry date and
5. not sharing eye make-up.

DOCUMENTED POLICIES AND PROCEDURES

Each practice should have a manual of infection-control procedures and a method to report and deal with 'sharps' injuries. The manual should include policies and procedures addressing the following:

1. hygiene and hand-washing procedures
2. handling and disposal of infectious waste and sharps
3. cleaning and decontamination procedures for all surfaces and equipment
4. tracking procedures
5. validating and calibrating sterilisers and sterilisation processes
6. use of protective clothing and equipment and
7. needlestick injury protocol.¹⁰¹

ADDITIONAL PRECAUTIONS IN THE EVENT OF A PANDEMIC (PANDEMIC USUALLY ADVISED THROUGH HEALTH DEPARTMENT IN THE JURISDICTION)

The human influenza virus can be spread from person to person by inhalation of droplets produced while talking, coughing or sneezing and through direct and indirect contact. The virus can persist on hard surfaces for up to two days. The infectious period can last from one day before symptoms appear up to seven days after the onset of symptoms.¹⁰²

Specific information for optometrists and their staff regarding infection control procedures for influenza A (H1N1) include:¹⁰³

1. isolating those who display symptoms indicative of influenza
2. use of surgical masks (P2 [N95]) by the infected person and health-care workers in close proximity to an infectious patient to reduce the risk of infection through small particle aerosol transmission
3. frequent hand washing by person after contact with respiratory secretions and contaminated objects or materials (pedal-, elbow- or sensor-controlled taps mean that contaminated hands do not need to touch taps)
4. appropriate cough and sneeze etiquette
5. provision of tissues and request to infected person to use tissues to cover the nose and mouth, when coughing or sneezing
6. immediate disposal of tissues into a hands-free waste receptacle
7. rescheduling of non-urgent appointments for those thought to be infected and
8. any staff members who need to be closer than one metre from the infected person should also use personal protective equipment (for example, surgical masks, goggles or safety spectacles, gowns and gloves).

Optometrists should be alert to any new guidelines issued by the Australian Government Department of Health regarding diseases, such as pandemic influenza, Zika virus or Ebola (see www.health.gov.au). This is relevant with a recent report of the detection of viable Ebola virus in the aqueous humour of a patient with successfully treated Ebola virus disease.¹⁰⁴

Optometrists infected with blood-borne viruses must comply with any relevant guidelines or standards of the Australian Health Practitioner Regulation Agency, the

Optometry Board of Australia and the Communicable Diseases Network Australia.

CONCLUSIONS

All practitioners should adopt measures to minimise the risk of transmission of infection. Single-use instruments and equipment should be used whenever possible but when reuse is required, appropriate methods of reprocessing should be applied based on the intended use of the device. Practitioners should balance the potential risks of transmission with the resources available to achieve disinfection or decontamination. As a minimum, standard precautions should be employed routinely and more rigorous procedures should be applied for infected people or immunosuppressed individuals, including people with AIDS, those taking certain types of chemotherapy and those who have recently received an organ transplant.

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**APPENDIX 1. LEVELS OF DISINFECTION ACCORDING TO TYPE OF MICROORGANISM
(modified from the Canadian Association of Optometrists Infection Control Guidelines 2016)⁸²**

Level of disinfection	Vegetative bacteria	Tubercle bacillus	Spores	Fungi (includes asexual spores but not necessarily chlamydo spores or sexual spores)	Lipid and medium size viruses	Non-lipid and small viruses	Prions
High	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	High-level disinfectant chemicals are capable of actual sterilisation only with extended exposure times	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	No killing effect ⁹³
Intermediate	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Variable: some intermediate-level disinfectants can be expected to exhibit some sporicidal action	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Variable: some intermediate-level disinfectants may have limited virucidal activity	No killing effect ⁹³
Low	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Little or no killing effect	Little or no killing effect	Variable	Killing effect expected when the normal use concentrations of chemical disinfectants or pasteurisation are properly employed	Little or no killing effect	No killing effect ⁹³

APPENDIX 2. RECOMMENDED CLEANING AND DISINFECTION PROCEDURES

(adapted from cockburn and lindsay, 1995) (note: when autoclaving is used the recommended temperature/time is either 134°C for at least three minutes OR 121°C for at least 10 minutes)

Item	Storage	Before each use	After each use
Alger brush burr	Store in clean, closed case	Not applicable	Consider manufacturer's instructions, for example, http://www.lrinstruments.com.au/assets/manuals/usermanual_algerbrushii.pdf ; http://www.algercompany.com/brush/wp-content/uploads/2013/01/Algerbrush-II-Operating-Instruction-Rev-3_2012.pdf
Contact lenses Rigid gas-permeable contact lenses ^{77,78,81}	Dry storage	Inspect visually for defects. Thoroughly clean the surface and rinse prior to reuse Avoid contact with patient's lids	1. Decontaminate immediately after contact with eye. Do not allow to dry. If this is not possible, keep lens in container of Water for Irrigation BP or sterile normal saline until the lens can be decontaminated 2. Rinse with Water for Irrigation BP or sterile water or sterile saline for at least 30 seconds 3. Decontaminate contact lens with approved gas-permeable cleaner via digital cleaning (20 seconds per side) to remove cellular debris and adherent protein 4. Rinse with sterile preserved/aerosol saline or sterile water for at least 30 seconds 5. Soak in three per cent hydrogen peroxide (H ₂ O ₂) for a minimum of three hours or freshly prepared solution of sodium hypochlorite providing 10,000 ppm of available chlorine for 10 minutes 6. Rinse in three changes of Water for Irrigation BP or sterile preserved/aerosol saline for a total of not less than 10 minutes 7. Remove excess water 8. Dry lens with a clean tissue and store in a clean, dry container. There is significantly less risk of contamination during dry storage compared to long-term storage in conditioning solutions 9. Gas-permeable lenses must be thoroughly surface cleaned and rinsed prior to reuse
Hard (polymethyl methacrylate) lenses			As for rigid gas-permeable lenses An alternative for most hard lenses is disinfection using heat treatment (78-80°C for 10 minutes). ^{73,82} Note that this is a shorter duration and lower maximum temperature than that recommended for soft lenses
Soft contact lenses ⁷⁷	Store disinfected lenses in saline in tightly sealed vials	Inspect visually for defects Insert direct from vial Avoid contact with patient's lids	1. Clean contact lens with a hydrogel lens cleaner via digital cleaning (20 seconds per side) 2. Rinse with sterile preserved/aerosol saline 3. Fill glass vial with sterile saline 4. Seal vial and label it with lens parameters and date of heating. Sterilise in autoclave at 134°C for at least three minutes or 121°C for at least 10 minutes 5. Alternative: thermal disinfection unit 78°C to 90°C for 20–60 minutes 6. (Optometrists could consider asking a local dentist or general medical practitioner to autoclave contact lenses, if they do not want to purchase their own bench-top unit)
Trial disposable contact lenses	Manufacturer packaging	Inspect visually for defects Insert direct from blister pack Do not use if packaging is damaged Avoid contact with patient's lids	Discard lenses

Appendix 2. Continued

Item	Storage	Before each use	After each use
Contact lens trial set cases			Clean thoroughly and either disinfect with H ₂ O ₂ or autoclave if the product can tolerate heat
Contact lens cases for use in practice/ stainless steel bowls (note: glass vials are recommended for placing contact lenses in while the patient is at the practice)			Clean thoroughly with cleaner and scrubbing brush and boil/autoclave
Dropper bottles	Store product in temperature range recommended by manufacturer Refrigerate if appropriate Mark opening date on bottle Discard by due date or one month after opening, whichever is earlier Discard if used on infected eye Consider Minims Hold the cap in your hand during use without touching the inside of the cap	Avoid contact of tip with hands, patient's lashes, eye or lid If infection suspected use Minims or a disposable dropper or glass rod to apply	Replace cap without hand touching dropper tip
Dyes (fluorescein, phenol red, rose bengal and lissamine green) and Schirmer strips	Use only if from a sterile pack	Wet dyes before use with unpreserved sterile saline If infection suspected use different dye strips for each eye	Discard after use
Foreign body needle	Keep single-use, sterile packed hypodermic needles and STERILE cotton buds	Prevent needle contact with hands or any surface before use	Discard in sharps container Avoid needlestick injury
Foreign body spud	Store in clean, closed case	MUST be autoclaved between patients	Clean thoroughly with soap and running water and MUST autoclave after use
Fundus lenses (contact)	Store in clean, closed container	Use current date contact medium from clean dropper or Minim	See process for gonioscopy lenses
Fundus lenses (non-contact)	Store in clean, closed container		Remove any bio-material with soap and running water, rinse Dry with lint-free cloth or air dry in clean area. Disinfection, if infection suspected, see process for gonioscopy lenses
Gloves (must be powder-free)	Store in box	If gloves are worn, use new gloves for every patient	Dispose of immediately after use. Wash hands before and after use
Gonioscopy lenses	Store in clean, closed case	Use current date contact medium from clean dropper or Minim	Consider manufacturer's instructions Clean the entire lens in a clockwise fashion, so as not to unscrew the ring, using a mild pH neutral detergent with a clean soft cotton cloth or swab. Do not use detergents with any type of emollient

Appendix 2. Continued

Item	Storage	Before each use	After each use
			<p>Disinfect with one of the solutions listed by Volk. One recommended solution is made up of one part 5.25 per cent sodium hypochlorite (NaClO)/household bleach to nine parts water (resulting in 0.525 per cent [5,000 ppm] NaClO). Fresh solution is recommended each time</p> <p>Position the lens on its side, then immerse the entire lens in the sodium hypochlorite solution for a minimum of 10 minutes and no more than 26 minutes</p> <p>Remove the lens from the solution and thoroughly rinse with room temperature water, then dry with soft, lint-free cloth⁹³</p>
Hands	<p>Keep fingernails clean and of reasonable length</p> <p>Keep powder-free surgical gloves for use if hands or patient have exposed lesions</p>	Wash hands with soap and water before examination commences	<ol style="list-style-type: none"> 1. Wash hands after all examinations 2. Wash hands after removal of gloves 3. Remove any jewellery including watches 4. Wet hands thoroughly with water (to decrease the risk of dermatitis avoid using hot water) 5. Apply recommended amount of product to hands (use liquid hand-wash dispensers with disposable cartridges and disposable dispensing nozzles. (A pH neutral liquid soap may be suitable) 6. Rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers 7. Rinse hands under running water 8. Dry thoroughly with disposable towel, patting hands dry to minimise chapping (do not use multiple-use cloth towels or hand-dryers) 9. Use disposable towel to turn off tap, if elbow or foot controls not available <p>Additional recommendation: use non-perfumed, hypoallergenic hand creams to avoid cracking of skin/dermatitis, for example, sorbolene</p>
Head rests, chin rests and brow bar	Not applicable	Wipe with isopropyl alcohol swab	Wipe with isopropyl alcohol swab
Lacrimal lavage probe (punctal dilator)	Store in clean, closed case	Swab with isopropyl alcohol swab	Wash with soap and running water, swab with alcohol and air dry Alternatively, clean with three per cent H ₂ O ₂ and heat disinfect or autoclave Return to covered container
Lacrimal lavage cannula	Use disposable modified single-use syringe and cannulae If using reusable cannulae, store in sealed container	Use saline from freshly opened container (20 ml disposable unit dose)	Dispose of syringe in sharps container If using reusable cannulae, autoclave before reuse (sterilise for at least three minutes at 134°C or for at least 10 minutes at 121°C) Alternatively, flush with three per cent H ₂ O ₂ and boil for 10 minutes Return to sealed container
Lid retractors	If metal instruments are used, store in clean, closed case	Wash in soap and water or alcohol swab and air dry	Discard any cotton buds used Wash metal instruments in soap and running water, alcohol swab or autoclave if infection suspected
Mastrota paddle (for meibomian gland expression)	If metal instruments are used, store in clean, closed case Cotton buds may be used	Wash in soap and water or alcohol swab and air dry	Discard any cotton buds used Wash metal instruments in soap and running water, alcohol swab or autoclave if infection suspected
Occluders/eye patch	Store in clean, closed container	Use paper tissue between occluder/eye patch and eyelids	Discard tissue Replace patches regularly Alcohol swab plastic patches after use
Ophthalmoscopes (direct, monocular indirect, binocular indirect)	Store in clean, closed case	Alcohol swab surfaces that may contact face, lashes etcetera	Alcohol swab if infection suspected

Appendix 2. Continued

Item	Storage	Before each use	After each use
Pachymeter (ultrasound) ¹⁰⁵	Store in clean, closed container	Air dry	Wipe probe tip with 70 per cent isopropyl alcohol Immerse the tip for 10 minutes in 70 per cent isopropyl alcohol Rinse in sterile distilled water and air dry
Phoropter / refractor head	Cover with dust cover overnight	Alcohol swab area that may contact patient's face	Alcohol swab if infection suspected
Schiötz tonometer	Store in clean, covered case	Not applicable	Disassemble Wash in running water Swab footplate with alcohol
Scleral depressors, lid evertors, specula, forceps	If metal instruments are used, store in clean, closed case Cotton buds may be used as evertors and depressors	Wash in soap and water or alcohol swab and air dry	Discard any cotton buds used Wash metal instruments in soap and running water, alcohol swab or autoclave if infection suspected
Spectacle frames	Ensure frame display area is cleaned regularly	Not applicable	If infection suspected, swab with isopropyl alcohol
Stethoscope	Ensure storage case/ bracket is clean	Swab bell and diaphragm with isopropyl alcohol Clean ear pieces if sharing with other practitioners	If infection suspected, swab with isopropyl alcohol
Thermometer	Store in clean, closed case	Wash with soap and water	Wash with soap and water Swab with isopropyl alcohol
Tonometer probe (Perkins or Goldmann)	Have two prisms so that one can be soaking while the other is being used Store in clean, closed container when not in use	Air dry	1. Clean tonometer prism with soap and water before debris has dried 2. Rinse off the soap or contact lens cleaner with sterile water/saline before disinfecting 3. Soak prism on its side for five minutes fully immersed in three per cent H ₂ O ₂ , 70 per cent isopropyl alcohol or 1:10 dilution of bleach ⁸³ 4. Rinse with sterile water/saline and air dry Note: if the household bleach is five per cent sodium hypochlorite this is equal to approximately 50,000 ppm available chlorine, thus when nine parts of water are added to one part of bleach, the resulting strength is 5,000 ppm available chlorine ¹⁰⁶ Consider manufacturer's instructions, for example, http://www.haag-streit.com/fileadmin/Haag-Streit_Diagnostics/Tonometry/Instructions_for_use/How_to_disinfect/USA_HowToDisinfect.pdf .
Trial frame	Store in clean, covered container	Alcohol swab area that may contact patient's face	Alcohol swab if infection suspected
Tweezers (plastic for contact lenses)	Store in clean, covered container		Clean manually with a contact lens daily surfactant cleaner, rinse with saline, dry with a tissue If possible, disinfect in a thermal disinfection unit 78°C to 90°C for 20–60 minutes