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Review

Hand hygiene prior to contact lens handling is problematical

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ABSTRACT

Purpose: To establish guidelines for contact lens wearers' hand hygiene practices which achieve a balance between minimising risk of infection and reasonable expectations on the ability of patients to follow them.
Methods: Evidence has been obtained from publications via PubMed, Advanced Medline Search, Cochrane Reviews, Google Scholar and using the key words hand hygiene, washing and contact lens.
Results: Guidelines for effective hand washing and the bother involved vary according to the level of hygiene required. High levels of non-compliance with hand hygiene practices, even among healthcare workers, gives an indication of how important the level of bother involved when following guidelines can be in contributing to non-compliance.
Conclusions: Better patient education to improve hand washing techniques as well as patient attitudes toward hand hygiene are needed to reduce high non-compliance levels. Better hand hygiene techniques and higher frequency of their application give the prospect of reduced risk of infection and of any discomfort that arises from increased lens and ocular bioburden. In order that adoption rates might be maximised, the guidelines which have been distilled from this review attempt to strike a balance between technique redundancy and the associated higher levels of hygiene achieved and the possibility that the perception of too much bother involved could reduce participation rates. The guidelines have been expanded by the inclusion of suggested explanatory information in the expectation that helping patients to understand why the recommendations are made will have the effect of increasing their adoption.

1. Introduction

Microbial keratitis (MK) is a rare complication of contact lens wear but it is of special interest because it is both a major cause of new cases of MK in the population, and the only sight-threatening complication of an otherwise safe method of vision correction [1,2]. Risk factors for microbial keratitis in contact lens wearers include less frequent hand washing, overnight wear, smoking [3,4] and case contamination [5]. These factors are not necessarily independent contributors to risk. Opening a case may contaminate fingers just as poor hand hygiene may contribute to case contamination and smoking may increase the need for more strenuous hand hygiene practices [6]. In addition, contact lens-related infections can be associated with microbes entering the eye from the wearer's lid margins [7]. The presence of a substantial lid and conjunctival bioburden is associated with a 2.5-fold (lid) and a more than 4-fold (conjunctiva) greater risk of substantial lens bioburden and is likely a major route of lens contamination and eye infection [8]. Fingers may become contaminated during lid manipulation required to maintain a wide aperture during lens insertion and removal. Apart from the number of bacteria, bioburden on the eye is increased by the metabolic stress imposed by them [6]. Such stress may depend on the level of bacterial toxins, enzymes and by-products on ocular and lens surfaces [6]. Consequently, apart from infection, poor hand hygiene can be associated with other forms of complication due to increased bacterial bioburden potentially contributing to the development of symptoms, a reduction in wearing times and even ultimate failure to continue with lens wear [9]. In addition, inflammatory responses to bacterial bioburden such as palpebral and bulbar conjunctival injection and corneal inflammatory events [6], may be exacerbated by pre-disposing conditions such as ocular allergy, and other diseases associated with reactive eyes such as, blepharitis, meibomitis, and adnexal dermatitis [10]. Consequently, apart from hands/lens/case/eye contamination interchange during insertion and removal, there is the risk of eye/fingers contamination interchange if there is eye touching during lens wear. Any finger/rubbing eye contact during lens wear may be in response to symptoms of dryness, itch, and other forms of irritation or when a displaced lens needs repositioning or an irritating lens needs cleaning and rinsing for example. Bacteria, blepharitis scales, air-borne allergens, and other foreign matter collected by the lashes, may be transferred to the ocular surface by lid contact with fingers during these activities. Patients, especially those with substantial lid bioburden may benefit from using warm compresses prior to lens handling. In the morning compresses remove crusts from the lids

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and otherwise reduce lid bioburden prior to lens insertion. Most patients, especially those exposed to airborne contaminants during the day, may similarly benefit from warm compresses prior to lens removal at night.

All lenses that were handled by patients during removal were found to be contaminated with microbes [11] whereas aseptic lens removal resulted in only 4% of lenses being shown to be contaminated [12]. Given that eyes are susceptible to infection by many organisms, hand washing is the most important fundamental principle of eye infection control [13]. Hand washing was found to significantly reduce contact lens contamination [14]. In a perfect world, improved lens performance and a reduction in the risk of lens contamination and eye infections can be achieved by adherence to appropriate hand hygiene guidelines. However, there are several disjuncts between theory and practice in this problematic area. Some patients never wash their hands prior to lens handling [9]. On the other hand, to achieve greater reduction of risks, built in redundancy is needed in hand washing technique [15]. Unfortunately, if built in redundancy results in the recommended standard becoming too high, the perception of too much bother by patients could reduce compliance. There is a great difference between the hand hygiene requirements that are appropriate for a surgeon and those that can be expected of contact lens wearers. For example, removal of rings by surgeons to achieve higher levels hand washing disinfection could become the type of hurdle that is just too high for some contact lens wearers. This requirement may explain lack of compliance with hand washing among health care workers [16].

2. How big is the problem among contact lens wearers?

Numerous studies have indicated that poor compliance with recommended contact lens use and care procedures (including hand hygiene) is a common problem [9,15,17–20]. A high prevalence of non-compliance has been shown to be common in all of 14 countries surveyed [21,22]. In addition, the findings from some studies may not reflect the true scope of non-compliance. In response to face-to-face questioning, 7% [9] and 11% [20] of contact lens patients admitted to not washing their hands. However, some patients may be too embarrassed to admit that they are negligent with hand hygiene and consequently overestimate their hand washing habits when asked to describe them [20]. Anonymous responses to a questionnaire may involve a higher level of honesty [9,23]. In one study 86% of respondents reported "yes" when asked if they were compliant with the use of their contact lenses with only 14% readily identifying themselves as being knowingly non-compliant. However, in practice only 32% demonstrated good compliance, 44% exhibited an average level of compliance, and 24% were non-compliant [9]. This means that at least some non-compliance was subsequently found for 68% [9]. Clearly, hand hygiene compliance studies that rely on patient's reported practices can always include overestimation of compliance standards [15]. The scope of the problems associated with hand hygiene is probably greater than indicated by these studies of frequency of hand washing. Apart from the many contact lens wearers who do not regularly wash their hands, there are many who do not use effective hand washing techniques. Asking patients to demonstrate how they behave also appears to be a more reliable indicator of performance [24] although patients can also behave to a higher standard of compliance when being observed [15]. Notwithstanding this Hawthorne effect, deficiencies in technique are nevertheless commonly observed, apparently because of deficient knowledge of effective hand hygiene practices [25]. However, adequate knowledge of effective hand hygiene methods is not a sufficient condition for compliance if the motivation to be compliant is lacking.

3. Poor standards amongst health care workers including contact lens practitioners

Poor hand hygiene was found to be a common risk factor for hospital acquired keratoconjunctivitis [26]. Other hospital acquired infections cover a wide spectrum including septicaemia and respiratory tract infections [27]. This should not be surprising because standards of hygiene practises can be very low amongst health care workers in hospitals with hand washing frequency and technique both found wanting [16]. Health care workers have been found to have 3.9×10^4 to 4.6×10^6 aerobic bacteria colony-forming units on their hands [16]. Despite this level of contamination, many health care workers in areas where infection is easily transmitted from one patient to another on contaminated hands, do not wash their hands as often as is required during the day [16]. A study of 200 contact lens practitioners asked them to rate their own hand hygiene practises [23]. Responses were anonymously recorded so that a greater level of honest self assessment may have been involved [23]. Following participation in practical workshops using UV radiation and a disclosing gel to demonstrate the efficacy of their hand washing techniques, these practitioners re-evaluated their ratings [23]. Only 25 (12.5%) rated themselves as excellent prior to the workshop demonstration of deficiencies in their techniques [23]. However, this number dropped to only 5 (2.5%) after the workshop demonstration [23]. Similarly, while 44 (22%) initially rated themselves very good, only 20 (10%) maintained that rating for themselves after the workshop demonstration [23]. These results suggest that contact lens practitioner knowledge of, hand hygiene techniques, can be improved and probably also their motivation to set a good example for patients. It is not surprising then that there is a lot of room for improvement in the hand hygiene habits of contact lens wearers. Only 27% of wearers reported an awareness that hand hygiene was an important factor in avoiding complications [15]. This result appears to be at odds with the finding that 88% of another sample of contact lens wearers reported washing their hands prior to lens handling [20]. However, effective washing may not be routinely practised. For example, the use of soap was not specified in that study and some subjects may only rinse their hands with water as a token form of hygiene [20]. Sponsor-masked online survey responses found that 56% reported always washing their hands with soap prior to lens insertion and 51% always washed their hands with soap prior to lens removal [28]. Assuming that these findings are more reliable, there is clearly room for a lot of improvement with the possibility of reducing the number of cases of microbial keratitis. In addition there is the possibility of reducing the much greater number of people (about 20% each year) [29] who fail to continue with contact lens wear because of symptoms of discomfort. As mentioned above and below, discomfort may be due to problems with increased lens and ocular surface bioburden which could be causally associated with poor hand and lid hygiene.

4. Why is non compliance so prevalent?

Non-compliance is higher when treatment is prophylactic [15]. Recommendations for good hygiene are primarily preventative but as there is usually no apparent immediate benefit or threat, motivation to be compliant may be undermined [20]. For patients who rarely wash their hands the lack of any apparent problems initially could increases the chance that rigid/time consuming recommendations are less likely to be adopted. Training in the need for and significance of hand hygiene amongst health workers does not ensure high standards [16,24]. For example, explanations given

by health care workers in a Post-Anaesthesia Care Unit explaining why they did not wash their hands repeatedly through the day included "it is too inconvenient", "I don't have time", "I do not need to wash my hands", etc. [16]. In relation to contact lens wear, and to personal risk of infection, 79% of contact lens wearing health care workers at a university hospital admitted to being non-compliant with their lens care [19]. For any patient, exposure to the non-compliance of friends may also be involved resulting in uncertainty about what should be done. There is clear evidence that some patients do not remember or understand properly what standards are required, or even why there are standards. In one survey 27% of patients reported that hand washing would increase the risk of a complication! [15]. This finding suggests that a significant number of patients are not instructed on hand hygiene. Some contact lens practitioners, who as shown above, can be unfamiliar with effective hand hygiene techniques, are possibly unable to provide appropriate instruction for their patients.

5. What can be done?

Fortunately, poor compliance with hand hygiene practises is one of the modifiable elements of overall contact lens handling compliance [22]. However, guidelines for effective hand washing vary according to the standards of hygiene required. For example, for optimum hand hygiene enough soap should be used cover all hand surfaces and the duration of the washing procedure should be 30 s [8] or 40–60 s [16]. Although built-in redundancy for hand hygiene methods achieves a higher level of safety [15], compliance is reduced by regimen complexity [9] and inconvenience [15]. Unfortunately, that even a 15 s total time can be difficult to achieve routinely was indicated by a sample of health care workers who were found to only take only an average of close to 5 s [30]. However, recommendations for appropriate hand hygiene procedures to be used before handling contact lenses are problematical for reasons other than the duration specified. Rather than specifying a time for a total washing procedure, it may be better to specify the thorough completion of the several stages of effective techniques. In addition, depending on exposure to contamination, procedures which are appropriate for some people will not be appropriate for others. A gardener or trades-person, whose hands are more routinely and obviously soiled, appears likely to require much greater hand hygiene effort than a white collar worker for example. Unfortunately, a white collar worker may make the mistake of assuming that lack of obvious soiling excuses thorough hygiene practises. It could be argued that any hand hygiene procedure is better than none at all. However, there is a good chance that the methods used by some patients are much less than adequate, even approaching a level of having no practical value. For example, rinsing without using soap and failure to dry could be more likely to increase contamination including the possible addition of water-borne microbes such as acanthamoeba. A worse situation could arise if rinsed hands are dried using a soiled/contaminated multiple-use communal towel. Failure to dry after lathering and rinsing effectively does not eliminate exposure to water borne microbes such as acanthamoeba. For example, trials with five different hand washing procedures found that with subsequent lens handling the procedures used (described as ordinary hand washing methods some of which included not drying at all and drying with a towel) did not decrease, and sometimes increased the amount of contaminants transferred from the hands to lenses [31].

6. Teaching hand hygiene

Teaching hand hygiene at the contact lens prescribing visit reduces the large new information burden at the lens handling instruction/delivery visit [32]. This approach increases the potential for retention of the details of the recommended technique, especially as the recommendations can be practised, prior to preparing and/or eating food, after using the bathroom or public transport as well as after activities which usually lead to hand contamination such as attending to garbage disposal. Such practice can be taking place prior to lens collection. Whilst there were no significant differences after washing at the start of a 1 year trial, post-wash results were significantly better after 1 year [33]. However, in that study, participants were telephoned weekly and visited monthly for the year of the study [33]. Nevertheless, this finding suggests that there is a cumulative benefit from maintaining good washing habits. Presumably, hands which have more recently been cleaned are easier to clean on the next occasion. A demonstration of the inadequacy of habitual hand hygiene procedures can be a very effective method of improving attitudes towards the need for adopting improved techniques [34]. However, it can also be embarrassing for the patient. Apart from health workers, very few patients are found to have even a satisfactory level of hand washing technique if asked to wash their hands. To avoid causing them embarrassment, it is usually better to firstly demonstrate good technique for them, and then ask them to show that they can follow the model demonstrated. This sequence saves time that would otherwise be taken for their first attempt.

7. Improving instruction outcomes

Within minutes of a consultation patients forget as much as 50% of the advice provided [15]. Average learning retention rates for different kinds of teaching vary from approximately 5% for a lecture, 10% for reading once, 20% for a demonstration, 30% for a discussion group, 75% for practice by doing and 90% for teaching others [35]. Apart from demonstration and practise by doing during the instruction session, the suggestion for contact lens wearers to teach their family members good hygiene practices has the potential to help improve their retention of recommended details. Compliance can be improved by helping patients to understand the reasons for good hygiene [15] in addition to being shown how it can be best achieved. Commentary provided during a demonstration of technique can help to rationalise each of the recommended steps and will, hopefully raise both patient understanding of hygienic practices and, accordingly, compliance with them (Table 1). Assistants who are given the task of providing hand hygiene instruction need to be trained to use the commentary which will give them authority for the example they set for patients with their demonstration of good technique. Take-home or send home written advice can support in-office verbal recommendations (Table 2). The reminder effect of sending parts of Table 2 on a message-by-message basis may be more beneficial than providing all the information in one document. Such occasional reminders of the importance of hand hygiene should help maintain motivation.

8. Other problematical issues

Air blowing and warm air hand driers are difficult to recommend. Clinical trials have established that between 80 and 90% of bacterial contaminants found in post-surgical wounds come from germs present in the air of the operating theatre [36]. The location of air blowing and warm-air driers in bathrooms and toilets, and the much greater levels of airborne germs, seems even more likely to be associated with hand contamination. Jet air and warm air driers have been found to increase post-washing contamination on hands when used in public washrooms [37]. In addition jet air driers can disperse contamination from hands to other users and into the washroom environment [37]. Warm air driers and jet

Table 1
Explaining the reasons for optimising washing techniques can improve compliance. The following examples of commentary to explain why each stage of hand washing is important can usefully accompany a demonstration of effective hand washing.

1. Washing your hands properly is like polishing the car. Firstly rubbing and rinsing with water to remove superficial dust and dirt. The first stage of hosing and sponging the car is like rinsing and rubbing your hands. Applying polish to the car requires rubbing to cut into the hard to remove dirt. Similarly, lathering your hands with plenty of soap requires rubbing to help loosen dirt and germs from the skin. Removing the polish to create a shine creates the cleanest paint surface for the car. Similarly, rinsing thoroughly to remove all traces of soap also gets rid of the germs in the soap which have been loosened by the lathering. It is like rinsing off all the dirty wash-up water before drying cups and plates.
2. When people use their hand to cover their mouth and nose to cough and sneeze or fail to observe toilet hygiene, their hands become covered in germs. Germs are easily transferred to you when shaking hands on meeting these people, and from following them after they open or close a door, hold on to a support in a bus, grip the hand rail on an escalator, press a lift/elevator call button or pedestrian walk button at traffic lights, write with a community-use pen in a bank, push a supermarket trolley, handle cash, share a telephone or a computer keyboard, etc. Effective hand washing removes infection-causing germs which are picked up from all these kinds of surfaces which have been touched by people who have dirty/contaminated hands.
3. Water contains some particularly nasty germs which can cause serious infections if they enter your eye with a contact lens or by touching with your fingers. Also, germs love moisture and drying your hands thoroughly is very important. A 'single-use' paper towel sheet (as used in the kitchen, for example) is ideal for this purpose as is paper or single-use towel from a dispenser. Paper tissues are also an option.
4. To avoid re-contamination of your fingers with germs after washing them, the paper used for drying (or a paper tissue) should be used to open your contact lens case, to turn off the tap, and to open the door when you exit the bathroom.
5. Germs can cause redness and dry eyes. Removing as many germs as possible not only reduces the chance of getting an eye infection but also reduces the chance of having red eyes and developing symptoms of dry eyes and dry contact lenses.

air driers can become contaminated by touching and can, consequently, re-contaminate washed hands which accidentally come in contact with them [37]. Warm air driers are slow and impatient users can fail to complete drying [37]. Drying with single use paper or cloth towel raises the level of hygiene by reducing the number of germs that remain on wet skin including acanthamoeba and other microbes found in tap water [38]. However, 44% of a sample of 2000 Europeans reported that they found air driers to be the most hygienic [37]. This finding suggests that many patients would benefit from knowing of the disadvantages of air driers.

Use of alcohol rubs or wipes is also problematical. The risk of damage to lenses [39], or eye irritation if eyes or contact lenses pick up left over alcohol from the hands, indicates that hand washing with soap and water is the better recommendation for all contact lens handling. However, when hand washing is not possible alcohol-based hand cleaning solutions and gels and wipes could be used. The risk of damage to lenses or eye irritation if contact lenses pick up left over alcohol from the hands can be minimised by making sure that all alcohol is removed/dried from the skin before lens handling.

Water temperature does not seem to be an important factor. When washing in water at 29 °C was compared with 43 °C, a statistically insignificant improvement in contamination reduction was detected with the higher temperature but again there was a statistically insignificant increase in visual skin irritation, loss of skin moisture and trans-epidermal water loss [40]. Hand hygiene practices might be more successfully promoted if patients are encouraged to use water temperatures that they find to be the most comfortable. The preferred temperature appears likely to vary with seasonal changes in ambient and water temperature. Unless there is the potential for elbow or foot control of water flow [41], a manually controlled tap is always going to contaminated because it involves communal use, is always turned on with dirty hands and is rarely (if ever) disinfected. After being used for hand drying, the normally single-use paper is ideal for turning a tap off and reducing the risk of re-contamination of fingers. The same (now multiple use) paper towel can also help avoid re-contamination from door knobs or latches when exiting bathrooms.

9. Improving hand hygiene practises and the motivation to maintain them

Too much emphasis on the risk of infection may be unproductive because of the low prevalence of this type of complication. As a source of motivation to practise effective hand hygiene, it appears likely to be diluted by the absence of infection with contact lens wear following poor hand hygiene practises (or even none at all). The potential for poor hand hygiene to contribute to increased ocular bioburden, immune responses, including acute and chronic inflammation appears to be a greater risk. Inflammation is a key component in the pathogenesis of dry eye and can be initiated by chronic irritative stress such as contact lens wear [42]. Symptoms of dryness, especially at the end of the day, are the most common reason for contact lens failures [43–45]. Chronic redness is common in contact lens wearers. For example, pingueculae are more common in contact lens wearers [46] and are almost always associated with inflammation. Supplementing infection risk with the risk of discomfort, symptoms of dryness or the negative cosmetic effect of chronic redness, may help generate better motivation for maintaining effective hand hygiene practises. Patients may benefit from knowing [32] that (as cited above) [29] about 20% of them abandon contact lenses each year principally due to discomfort. An appropriately worded sign placed adjacent to hand hygiene facilities was found to increase hand washing in hospital settings [47]. A wash basin sign stating "THOROUGH HAND WASHING HELPS PREVENT INFECTION AND IMPROVE CONTACT LENS COMFORT" might have a similar positive influence on compliance. Apart from occasional exposure to such a sign for patients, the behaviour of practitioners and their staff may benefit from exposure to this form of reminder. A version of this sign which patients could fix inside a bathroom cupboard door might help. Similarly, having contact lens cases labelled or inscribed with "Always wash hands" could be helpful.

10. Increased compliance with increased frequency of contact with and from practitioners

Interventions in the form of aftercare at six monthly intervals, and self-review exercises conducted by email every three months were found to improve compliance significantly [48]. Deregulation of contact lens fitting and associated reduced interaction between qualified practitioners and patients has been suggested as a contributing factor for high levels of non-compliance [22]. Greater aftercare contact gives more opportunities for discussion to help maintain or raise standards. Lack of reinforcement is a barrier to compliance [25] and raising the possibility that non-compliance could be causing or contributing to symptoms or signs evident at aftercare has the potential to improve compliance [32]. In addition, at every aftercare consultation there is the opportunity for practitioners to demonstrate good technique as they wash their hands. This is also an ideal time to advise patients of important issues that have been demonstrated by hand hygiene research. Tables 1 and 2 list points which can be raised at aftercare, perhaps as a practitioner is washing her/his hands. In between aftercares, practise Newsletters and broadcast group emails can be used to disseminate useful supportive information that reinforces compliance.

The guidelines shown in Table 2 include firstly a version of the recommendations which requires an 11th grade level of reading (suitable for a reading age of 17 years). This version includes more explanatory material of the type which is intended to increase

Table 2
Hand hygiene for safe and comfortable contact lens wear: these take-home (or send-home) messages can be supplied on an item by item basis, as a single package or by both methods. The Summary version requires only a reading age of 11–12 years.

1. Eye infections are rare events but can be devastating and even involve permanent vision loss. They are more common among contact lens wearers because hands can transfer germs to the eye whenever lenses are inserted, repositioned, removed or even when tired, and itchy and irritated eyes are touched or rubbed. Germs on hands can also increase eye redness and reduce lens comfort even if there is no obvious infection. For example, eye redness can contribute to problems of dry lenses and discomfort, especially at the end of the day. Far too many people do not wash their hands effectively. Far too many people stop wearing contact lenses because of discomfort and dryness.
2. Hands should always be washed thoroughly before inserting, removing, settling or re-positioning lenses. Lid and lash cleaning using warm compresses before lens insertion or removal help to improve lid hygiene as well as eye and lens comfort.
3. There is an increased chance of lens contamination and eye infection for people who have a cold or influenza. The germs found in noses and throats of patients are the same ones which cause eye infections. Greater emphasis on hand hygiene is indicated at any time for this reason but especially when a patient has influenza or a cold. Abstaining from lens wear during this period is a better option.
4. Hand washing can improve lens comfort by removing hand lotion, residual make-up, or other oily contaminants from fingers which might otherwise make lenses uncomfortable or blurry.
5. There is an even greater need for effective hand washing when hands have become particularly contaminated while gardening or doing any other dirty task. Factory workers or patients working in certain trades such as plumbing will usually have more opportunities for heavy soiling of their hands. One complete wash cycle immediately followed by another is usually required by these people.
6. Alcohol-based hand cleaning solutions and gels and wipes can be used when hand washing is not possible. The risk of damage to lenses or eye irritation if contact lenses pick up left over alcohol from the hands can be minimised by making absolutely sure that there is no alcohol remaining on skin before handling lenses.
7. Medicated (germ killing or germicidal or disinfectant) soaps are recommended but, if unavailable, non-medicated types of plain soap is a satisfactory alternative but must also be used effectively. It is best to avoid, if possible, soaps containing lotion, oil or perfume.
8. Effective hand hygiene is achieved in stages. Start by rinsing thoroughly with water to remove superficial dirt and to improve the germ removal and killing effect of lathering with soap. Soaps can be an irritant to the eyes so it is important to make sure that all soap lather and germs are rinsed off. Using running water and vigorous rubbing of the skin to remove all traces of soap lather also improves hygiene by removing germs in the soap lather. It is important to avoid multiple-use towels for drying. Single use paper (as used in kitchens for example) or paper or single-use cloth from a dispenser are ideal for both removing water and reducing contamination. Drying thoroughly will reduce the number of germs on the skin including those that are found in tap water.
9. Taps are always contaminated with germs but can be safely turned off with the paper towel used to dry your hands. Your contact lens case can be opened using the same paper towel. Similarly for door handles and latches, the same paper towel can be used to exit the bathroom so that contact with door handle germs is avoided.
10. Air blowing driers, jet driers and warm air driers are not as good as single use paper towels for drying [37]. Germs in the air are blown onto the skin of your wet hands by the blower-drier and your hands become re-contaminated. The location of air driers in bathrooms and toilets increases the risk of re-contamination. However, if paper towels are not available, air blowing (jet or warm) drying may be the best alternative but make sure your hands do not come into contact with driers as they are frequently contaminated with germs [37].
11. Always wash your hands before handling lenses or touching your eyes. Rinse thoroughly with rubbing and strong running water. Apply soap and rub all parts of your hands. Rinse again with fast running water and rubbing. When hands are more dirty, repeat the lathering and rinsing. Dry with "kitchen" paper. Use the paper to turn off the tap and to open the door.
12. The benefits of regular hand washing accumulate and results have been shown to improve over time. Apart from contact lens handling, hands should of course be washed prior to preparing and/or eating food, after using the bathroom or public transport as well as after other activities which usually lead to hand contamination such as attending to garbage disposal.
13. It is a mistake to assume that having a "clean" office job for example, does not necessitate effective hand washing practices. Germs on hands can easily be acquired anywhere but especially from shaking hands with people who cover their nose and mouth when they have a cold and sneeze and cough or fail to observe toilet hygiene or from all kinds of surfaces that they touch such as door handles, taps on water fountains, banister rails, support poles on public transport, as well as sharing pens and phones, or handling money in the form of notes or coins for example.
14. Slapdash or superficial hand washing does not reduce the germs on hands and does not reduce contact lens contamination. For example, just rinsing with water does not help.

Summary

1. Eye infections are rare but can be a big problem. Sometimes they involve vision loss.
2. Infections are more common for contact lens wearers because fingers transfer germs to the lens and the eye.
3. Germs can increase eye redness and reduce lens comfort.
4. Germ transfer occurs when lenses are inserted, settled, repositioned or removed. Germ transfer to the eye also occurs when eyes are touched or rubbed.
5. Hands should always be washed thoroughly before touching your eyes or handling your contact lenses.
6. Using a warm face cloth to clean your lids and lashes before lens insertion and before lens removal will improve eye and lens comfort.
7. Hand washing reduces the risk of infection and discomfort. Oils can make contact lenses uncomfortable or blurry. Hand washing removes hand lotion, make-up and other oils.
8. Alcohol hand-rubs and wipes might irritate your eyes or damage your contact lenses. Washing with soap and water is better before handling contact lenses.
9. Always start by rinsing your hands thoroughly with water to remove dirt.
10. Germ killing (medicated) soaps are good. Plain soaps can also do a good job.
11. Rub the soap lather over all parts of your hands. Use strong running water and rubbing to rinse off all the soap lather. Rinsing helps remove germs.
12. Really dirty hands need two cycles of rinsing, soaping and rinsing.
13. Drying greatly reduces the number of germs on the skin. Single-use paper towels (as used in kitchens for example) or tissues are best.
14. Turn off the tap and open the door using the same paper towel. Air driers are not as good as single-use paper for drying.

compliance. However, many patients will find that version difficult to read [49]. A second version, which is designated as a summary, and which only requires a 6th grade level of reading ability (suitable for people with a reading age of 11–12 years) follows the first version. Providing the 'Summary' version will improve accessibility to this information for a wider range of patients. Apart from younger children and adults who are poor readers, this version will be more appropriate for many patients for whom English is a second language. In addition, reading the 'Summary' version as well, as the first, helps good readers to assimilate the advice. Either the entire Table 2 text or just the summary version may be a suitable hand-out after initial instruction. In the latter case, items from Table 2 can be distributed progressively to help maintain compliance. Some information is not easily reduced to a reading level that is appropriate for the summary version and this information duplicated in Table 1 is intended to be presented verbally during a consultation or a hand washing instruction session.

There is increased chance of lens contamination and eye infection for people who have a cold or influenza [50]. A high correlation was found between the germs taken from eyes, noses and throats of patients with bacterial eye infections [51]. This type of information may help improve compliance. Some practitioners might like

to strengthen the advice to provide additional safety. For example, a specific time for washing duration of 15, 30 or 60 s and/or always using medicated soap might be preferred recommendations. However, in a paired sample comparison, there was no significant difference between hand cultures obtained after 1 year of regular use of either plain or antimicrobial soap [33]. Recommendations to always use medicated soaps might tend to make the standard too difficult to achieve but, conversely, even if only available at home, the use of "special" medicated soap might help to entrench better hygiene habits. Similarly, the risk of spoiling lenses may be reduced by the use of soaps that do not contain cream, lotion, oil or perfume. Unfortunately, 20% of a sample of patients cited "too much bother" to explain their non-compliance with hand washing [15]. Setting too many conditions for acceptable hand hygiene practises may be counter-productive. Clearly hand hygiene is problematical in this regard and some compromises may be required. Given that some patients admit that they never or seldom wash their hands, some practitioners might prefer to soften the standards described in the instructions shown in Table 2. Other practitioners might like to raise the standard to achieve higher hygiene levels. For these reasons, the instructions (as well as the information (discussion points) in Table 1) are freely available as Word files from c.mcmonnies@unsw.edu.au so that they can be modified for use in individual practises.

Conflict of interest

There are no financial interests to declare in relation to this paper.

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