Efficacy of a contact lens cleaning device and its enhancement of the performance of contact lens care products

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Abstract
Background—Corneal infections due to contact lens contamination are risks associated with contact lens wear. Care systems which reduce these risks are desirable.

Methods—This study evaluated a contact lens cleaning device using normal saline initially and then four contact lens solutions.

Results—Using saline, six out of 10 tests resulted in complete removal of challenge organisms or showed reductions to 10 cfu/ml or <10 cfu/ml. Tests upon organism using multipurpose solutions showed >6 log reductions in 2–3 minutes. With laboratory made biofilms, similar results were obtained.

Conclusions—This device improves lens cleaning and enhances lens care solutions. When used correctly it should lead to significant reductions in microbial keratitis associated with inadequate contact lens hygiene.

The incidence of microbial keratitis in contact lens wear appears to be increasing and indications are that up to 30% of corneal ulcers are associated with contact lens wear.1 Lens wearers are increasingly seen in accident and emergency departments of certain hospitals.2 A contributing factor to lens wear complication is microbial contamination, and reports suggest that up to 95% of lenses in use are contaminated.3 Physical cleaning of lenses and lens cases, helps to reduce micro-organisms before chemical disinfection.4 Contact lens wearers and eye care practitioners may rely too much upon contact lens solutions to reduce microbial contamination.5 Studies indicate that several multipurpose solutions and peroxide systems are not able adequately to disinfect concentrations of bacteria (for example, Staphylococcus aureus) of 10^2–10^5 cfu/ml. The studies show that bacteria can survive chemical disinfection6 and they describe resistance to hydrogen peroxide by Candida parapsilosis, a yeast associated with cutaneous infections.7 Daily cleaning of contact lenses is not always properly performed by lens wearers.8 Levels of microbial contamination of 10^6 cfu/ml and above are common in used contact lens cases.9 This indicates that many commercially available lens care systems may not be adequate on their own. Use of monthly dispos-
The device was tested as described for saline, but substituting multipurpose solutions for normal saline. The treatments were performed in two cleaning cycles and the results were as follows.

The device when used with Miraflo and 10:10 solution eradicated bacterial biofilm on the lenses. After 2 minutes of cleaning there was no recovery of the test organism. The device when used with Opticlean and Optifree showed a >10 log reduction of planktonic challenge organisms.

Discussion

This lens cleaning device when used with normal saline alone met the criteria given in the International Standards Organisation’s directive ISO/CD 14729.3, which gives performance tests using bacteria and fungi. Previous studies have shown that physical rubbing of a lens with cleaning solutions can reduce micro-organisms by 10^6–10^7 cfu/ml or more. However, reports show that 32% of users do not clean their lenses at all after each use. The hands of a lens wearer may transfer contamination to a contact lens during cleaning and/or general lens manipulation. The new cleaning device minimises the use of the hands in lens maintenance while increasing cleaning efficacy. It is safe to use with soft, PMMA, and gas permeable contact lenses and does not change their surface properties.

Studies of Acanthamoeba keratitis report that contamination of a contact lens case with bacteria can support amoebae and enable them to feed. The cleaning device not only cleans lenses but also cleans its own storage case simultaneously, thus reducing the chance of lens case contamination.

Preliminary tests using a hydrogen peroxide care product surpassed the criteria given in ISO/CD 14729.3 and showed a >10 log reduction of the challenge organisms. Incubating the lenses for 72 hours after cleaning showed minimal growth (100 ml with Pseudomonas aeruginosa), but no colony forming units could be detected. Similar results were achieved when using Optifree and SOLOCare for 2–3 minutes. This device should help to significantly reduce contact lens wear complications that are associated with inadequate contact lens care procedures or contaminated contact lens cases.

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