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Preventing the Incidence of Fusarium keratitis Infection in Contact Lens Wearers

Olorunfunmi Adefioye-Giwa, Nearchos Stylandis and Zane Thornley
The Centre for Interdisciplinary Science, University of Leicester
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Abstract
Fusarium keratitis is a serious eye infection of the cornea that has recently been prevalent with contact lens wearers. In 2006, an outbreak of the infection was found to be mostly due to a certain brand of contact lens solution, ReNu with MoistureLoc®, which was withdrawn from the market. However, a very recent incidence of the infection that lead to blindness in the patient, has led to a necessity on educating contact wearers on the importance of proper handling of their contact lens. We highlighted the importance of not reusing contact lens solution due to the depreciation in its antimicrobial properties after one use. It was also recommended those contact lenses are stored in a barrel container which suspends the contact lens in its solution

Introduction
Fusarium keratitis is a fungal infection of the eye caused commonly by the fungi *Fusarium solani*. Between late 2005 and 2006, there was an outbreak of the infection in the United States. Of the 164 cases, 10 of the patients were non-contact lens wearers, while the remaining 154 patients were frequent contact lens wearers. 69% of the contact wearing patients reported using a specific brand of contact lens solution, ReNu with MoistureLoc®[1]. Despite negative results involving the test for the presence of Fusarium in the said lens solution and the factory of production of the solution, the ReNu with MoistureLoc® lens solution was withdrawn from the market.

More recently however, a particular case of *Fusarium* infection was reported in the UK where the infected patient had a severely damaged eye which had to be removed. The patient had used a daily disposable lens, Focus Dailies All-Day Comfort lenses, which had caused discomfort and eventually resulted in the infection with *Fusarium* fungi. The manufacturer of the lens claimed that a test of other Focus Dailies All-Day Comfort lenses yielded a negative result for any *Fusarium* fungi [2].

These infection incidents seem to highlight that, rather than the contact lens solution or the contact lens themselves, the handling of the contact lens by infected patients are likely responsible for their eye disease.

Manifestation and Treatment of the *Fusarium* keratitis
Fusarium is usually acquired generally from environmental sources such as soil or vegetation. The initial symptoms of the infection begin with an intense irritation of the cornea. The fungi grow slowly deep under the cornea producing a biofilm as it grows. Thinning of the cornea occurs, causing irregular astigmatism that cannot be corrected normally. Corneal ulcers (keratitis) are also formed causing a progressive loss of vision. No discharge is released by the infected eye; however, an infiltrate of white blood cells would be present in on the transparent edge of the cornea. Other symptoms would include a general redness of the eye, intense pain, increased light sensitivity and tearing of the eye.

Treating the disease requires application of antifungal drugs directly to the infected eye. The antifungal drug natamycin is applied hourly for a period of three days. This frequent application is due to low penetration of the drug through the biofilm created by the fungi. In the case of the presence of

dense cornea infiltrate, a keratectomy which involves the excision of the infiltrate from the cornea is performed. This procedure would be combined with treatment with natamycin. In the case of very severe cornea ulcer or infiltrate, a keratoplasty that involves the transplant of a donor cornea to the patient is performed.
If however the damage to the eye was extensive, the infected eye would have to be removed.

Prevention of *Fusarium* keratitis for Contact Lens Wearers

People who wear contact lenses either for medical or aesthetic reasons are at risk of several eye contaminations and in effect, infections. Thus, prevention against such infections like *Fusarium* keratitis would have to be based primarily on proper hygiene and care of the contact lenses.

Given the case of the 2005 – 2006 outbreak of the infection [1], it was noted that despite the fact that most of the contact wearing patients had used 'ReNu with MoistureLoc®' contact lens solution, a test of the solution and the environment it was manufactured yielded a negative result for the *Fusarium* fungi. Later on, a test on the result of using that particular solution with contact lenses showed that a single use of the solution did not increase susceptibility to contracting the infection; however, reusing the solution increases the likelihood of contracting the infection. The reason for this was based on the study of Rosental et al (1997) that showed that contact lens solution that is being used gradually lost their bactericidal activity. This would also mean that the 'ReNu with MoistureLoc®' solution would probably have lost its antifungal activity during first use. Thus, contact lens wearers that reused their contact lens solution would have been at a higher risk of contracting an infection such as *Fusarium* keratitis. This therefore brings to point that contact lens solution should always be fresh for every use.

For the recent case of the patient who was infected after a use of daily disposable lens [2], the fact that a test of the other lenses of the same brand yielded a negative result for *Fusarium* fungi means that the infection was likely due to unhygienic handling of the contact lens. There are several ways in which the contact lenses can be contaminated by the wearer or persons handling it. First of all, it is well known that the hands should be washed before handling the contact lens. However, it is possible that hands are not properly dried when handling the contact lens. A wet hand is a likely attraction to pathogenic microorganisms due to the fact that most microorganisms thrive in a damp or wet microhabitat. Thus it is important to dry hands just as it is important to wash them. The best material to use would be a sterilised disposable towel rather than a towel that is continually used. A reusable towel would harbour pathogens as time goes on. Also, air dyers should not be used since they can blow pathogenic microorganisms onto the hands. The dryers are not hot enough to eliminate many harmful microorganisms.
The storage of the contact lens is also important in reducing the risk of contamination. The most common storage container is a horizontal container in which the contact lens rest at the bottom of the container. This style of storage would likely increase the likelihood of contamination since the contaminant could easily settle on the contact lens stored in this position. A suitable form of storage would be to use the barrel storage container which suspends the contact lens vertically in a mesh. This would allow for proper flow of the contact lens solution over the contact lens. It reduces the risk of contaminants settling on the contact lens.

Conclusion

The severity of the fungi *Fusarium* keratitis has been demonstrated in this paper. It is a serious form of infection that could affect contact lens wearers. It was further explained that in order to prevent an occurrence of such an infection, proper care must be taken when handling contact lens. First, contact lens solution must never be reused since there is depreciation in their antimicrobial activity after one usage. In terms of hygiene practice, after washing of hands properly, hands must be dried thoroughly. The drying method should be with a sterile disposable paper towel (such as Kleenex), not a reusable towel or even an air dryer. Contact lenses should preferably be stored in a barrel container that suspends the lenses vertically and allows for the flow of the contact solution over the lenses.
If hygienic practices are strictly followed barring a manufacturing contamination, then the incidence of such infections like *Fusarium* keratitis would be

drastically reduced. But more importantly, contact lens solutions should never be reused due to the reduced effectiveness in preventing contamination by pathogenic microorganisms such as *Fusarium*.

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