Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Contact Lens Compliance: A Review

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Recently, contact lenses have been heavily covered in the media. Between the woman who had 27 soft contact lenses in her eye, and another woman who had a rigid gas permeable lens in her eye for 28 years, contact lenses are a hot news topic. These stories provide some examples of the ways contact lens wearers do not always follow best practices in the wear and care of their lenses, and further demonstrate that compliance to safe contact lens wearing practices remains a relevant subject today. This editorial reviews the recent literature on compliance and areas of non-compliance. In addition, promising technological advancements and tips to facilitate compliance within clinical practice are also discussed.

Compliance: Assessment and Influential Factors

A large disconnect exists between perceived and actual compliance exhibited by contact lens users. When asked about their lens wear and care, around 85% of patients report good compliance, but upon further investigation, the reality is somewhere between 1 to 50% achieving true compliance.[1-3] Joslin and colleagues found that 99% of contact lens wearers surveyed reported at least one risky contact lens hygiene behavior.[4] The participation in potentially hazardous behaviors does not appear to be related to a lack of knowledge, as 80% of patients surveyed were aware of established risk factors.[2] This point is further supported by a study that found no significant difference in compliance rates when comparing ophthalmologists, non-ophthalmologist physicians, nurses, and laypeople.[5] These results suggest that simply reviewing the risk factors with patients is not enough to support their compliance, and that clinicians must think outside the box to reinforce healthy behaviors.

A number of factors can influence the levels of reported non-compliance including peer groups,[6] perceived levels of behavioral control on health outcomes,[6] and general risk-taking behaviour.[7] Common reasons cited for non-compliance include saving money,[8] and forgetting the appropriate lens replacement schedule.[9] The best compliance with lens wear and care is exhibited by older females in higher income brackets who visit their eyecare professional at regular intervals.[9,10]

Extended Wear

Overnight wear of contact lenses has historically been associated with a four-fold increased risk of corneal infiltrative events (CIEs),[11] and at least a five-fold increased risk of microbial keratitis (MK),[12] with some estimates reporting around a ten-times risk compared to strict daily wear of hydrogel lenses.[13] However, around 25% of contact lens wearers report engaging in this behavior at least occasionally.[14] The risk associated with extended contact lens wear is not due to the lack of daily disinfection alone, which was demonstrated by a study that found no significant difference in adverse event rates between subjects who engaged in continuous lens wear and subjects who removed their lenses for disinfection each morning.[15] Clinicians should also be aware of the frequency of napping in contact lenses, which is reported by 47 to 87% of contact lens wearers.[16,17]

Lens Replacement

Contact lenses are prone to developing surface deposits over time,[18,19] therefore compliance with the recommended lens replacement schedule is important. Daily disposable lenses have grown in popularity over the previous decade and this lens modality of course reduces the opportunity for deposits to develop. The TEMPO registry found rates of adverse events associated with daily disposable lenses from 0.6 to 1.6% of patients per year, with slight variations between materials.[20] These rates are compared to historical adverse event rates of 3-4% of reusable lens wearing patients. Additionally, daily disposable lens wearers are more compliant with lens replacement when compared to monthly and two-week replacement lens users,[9,21] with the latter option associated with the lowest levels of replacement compliance.[21-24]

Patients are not in this alone, however, as the lens replacement recommendations given by doctors do not always follow the manufacturer recommended replacement schedules. Doctors follow manufacturer recommendations more frequently with daily disposable and monthly lenses than with two-week replacement lenses,[21] which may influence the aforementioned rates of replacement non-compliance in this lens modality. The amount and location of lenses purchased also correlates to the accuracy of lens replacement, with those who purchase annual supplies from their eyecare professional demonstrating the best compliance.[9]

Hand Hygiene

Humans come into contact with countless species of bacteria, fungi, and protozoa every day, therefore thorough cleaning of the hands is paramount prior to handling contact lenses. Poor hand hygiene is a risk factor for both sterile,[25] and microbial keratitis.[26] The use of soap and water is associated with lower levels of contact lens case contamination when compared to either no hand washing or using water alone.[27] Younger adults are less likely to engage in thorough hand washing when handling their lenses,[28] and contact lens wearers are more likely to wash their hands prior to lens insertion than prior to lens removal.[9]

Contact Lens Accessories

The use of contact lens disinfection products and storage cases has a profound impact on the development of bacterial biofilm and the risk of associated complications. Lens storage cases provide a significant potential source of infection, with 23-81% of cases found to be contaminated with microorganisms,[2,27,29,30] and the level of contamination increases with case age.[31]

When examining contact lens patient behaviors, Hickson-Curran and colleagues found that only 26% of the participants always cleaned their lens case, and the same percentage of subjects reported replacement of the storage case less often than annually.[23] A study that investigated available information concerning best lens case practices indicated that there is the potential for patient confusion, as inconsistencies exist among the recommendations given by the United States Food and Drug Administration (FDA), contact lens solution manufacturers, and optometrists.[32] The literature demonstrates that the most effective procedure for reducing case contamination involves rubbing and rinsing the lens case with disinfection solution, wiping the inside surface with a tissue, and then leaving the case open and upside down to dry.[33]

Although 90% of patients surveyed reported compliant lens care in a study by Donshik and colleagues, 27% used saliva to wet their lenses and 43% utilized tap water in some aspect of their lens care.[1] Neglecting to use fresh solution every night increases the potential for complications, and the behavior of “topping off” multipurpose solution was linked to the 2004 Acanthamoeba keratitis outbreak in the United States.[4,34] Several behaviors can increase the risk of lens case contamination, however a study evaluating the association of overall compliance with case contamination found that none of the fully compliant patients had appreciable storage case contamination.[35]

Water Exposure

Contact lens exposure to water is a well-established risk factor for microbial keratitis,[36] particularly the potentially visually devastating Acanthamoeba keratitis,[37,38] which a recent study reported to exist at outbreak levels in the United Kingdom.[39] Zimmerman and colleagues investigated the prevalence of water exposure in contact lens wearers, and although water exposure behaviors are much more common in rigid gas permeable contact lens wearers than in soft lens wearers, 31% of soft lens patients report rinsing their lenses in tap water, and 15% store their lenses in water.[40] Young adults are more likely to store or rinse contact lenses with tap water when compared to an older population.[41] Many patients introduce water to their contact lenses by cleaning their storage case with soap and water or water alone.[23]

The use of contact lenses when swimming or showering can also expose the lenses to water. Both the FDA and the Centers for Disease Control and Prevention (CDC) recommend the avoidance of contact lens wear while showering, swimming, and using hot tubs.[42,43] There is an increased risk of the development of microbial keratitis when wearing contact lenses while showering[4,34,44] and swimming,[45] the latter of which is associated with increased levels of contact lens bacterial colonization.[45]

Technological Updates

Research and development focusing on contact lens materials and accessories has the potential to augment comprehensive patient education concerning contact lens complications. A number of animal model studies reveal promising results when evaluating the performance of an antimicrobial lens material. The use of melimine-coated contact lenses resulted in less bacterial lens adhesion and a decrease in both the signs and degree of corneal infiltration when compared to uncoated lenses.[46,47] A recent study testing a povidone iodine disinfection system reported that the 4-hour protocol resulted in broad spectrum antimicrobial activity and efficacy against bacteria, fungi, and Acanthamoeba.[48]

Even contact lens cases themselves can possess antimicrobial properties. The use of silver-impregnated lens cases results in a reduced percentage of overall contamination and the isolation of smaller numbers of organisms.[49] When selenium is covalently incorporated into the lens case polymer, reduction of various Gram-negative and Gram-positive organisms is observed, and as an added bonus, selenium has fewer side effects and is less expensive than silver.[50]

The Clinician's Role

Given that contact lens non-compliance is such a pervasive issue, it may be easy to consider washing one's hands of the issue (unlike many of our contact lens wearers!). But it is not all doom and gloom, and as practitioners, we play an invaluable role in the health education of our patients. There are a number of ways to reinforce healthy contact lens habits:

TIPS	RESOURCES
Obtain contact lens history using open-ended questions to get a true sense of your patient's day to day lens practices	
Consider displaying signage in your office that reviews healthy contact lens habits	The CDC and BCLA have some great eye-catching options:[51,52] https://www.cdc.gov/contactlenses/posters.html https://www.bcla.org.uk/Public/Member_Resources
Review and observe proper hygiene and handling at each visit	
Review correct replacement schedule of lenses and cases at each visit	
Hand out guides that illustrate healthy contact lens habits; patients are more compliant with both verbal and written instructions versus verbal alone[26]	AOCLE has guides for soft, gas permeable, and scleral lenses;[53] similar resources may be available in your local markets Download the CORE handout on tips for compliant contact lens wear
Verbalize to patients that you are "prescribing" a specific disinfection protocol that best matches their lens materials and needs	

The noncompliant behaviors associated with potential contact lens complications are modifiable and well within the remit of the optometrist and patient to focus on and improve. Primary eyecare providers have an important role in ensuring information regarding safe contact lens wear and care is readily accessible to their patients. With the combination of patient education and future updates in contact lens technology, contact lens complications can hopefully be greatly reduced.

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