

Future Prospect of Antimicrobial Contact Lens Cases

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Contact lenses are worn by 145 million persons worldwide as a mode of vision correction. Although using contact lenses is typically safe but it can cause eye irritation and infection. In addition, microbes can contaminate contact lenses during their use leading to the development of microbial keratitis and corneal infiltrates. Microorganisms such as coagulase negative staphylococci found on the skin of eyelids as well as conjunctiva are the most prevalent microbes that infect lenses. Most studies estimate that 40-50 percent of lenses based on hydrogel or silicon hydrogels are contaminated, with minimal variation in rates reported from different geographical regions including Australia, India, and USA. In addition, daily disposable as well as daily wear and extended wear contact lenses are also having chances of contamination [1]. With these views, the above-mentioned issues associated with contact lenses can be overcome by developing antimicrobial coated contact lens cases, which would be quite promising for preventing case-borne infection.

The use of antimicrobial coated contact lens cases can inhibit bacterial adhesion and colonization formed on surface of contact lens due to biofilm formation in the former ones containing multipurpose solution, which eventually also prevent infection and inflammation.

The researchers have constantly been putting efforts to develop antimicrobial contact lens cases using several materials. So far among other materials, silver and selenium have become the central focus of researchers for the development of antimicrobial

coated contact lens cases due to their strong antimicrobial activities. However, only silver-impregnated antibacterial contact lens cases have received green signal for commercialization.

To date there are only three commercially available silver-impregnated cases namely MicroBlock (CIBA Vision, Atlanta GA), I-clean (Sauflon Pharmaceuticals Ltd., London, UK), and Nanocase (Marietta Vision, Marietta, GA). Notably, MicroBlock as antimicrobial case manufactured and owned by Ciba Vision Atlanta has recently been taken over by Alcon. Further, different types of silver-impregnated lens cases have different modes of action. In view of these, MicroBlock cases are more effective against gram-negative bacteria (such as *P. aeruginosa*), whereas I-clean cases are more effective against gram positive (such as *S. aureus*) [3]. In addition, selenium based antimicrobial contact lens cases are being investigated for their antimicrobial activity as well as their affinity of being covalently bonded to polypropylene polymer. Further, research has shown that selenium-based contact lens cases could inhibit the growth of *S. aureus*, which would eventually prevent biofilm formation. Moreover, selenium based antimicrobial contact lens cases are not yet commercially available. But it has been proven that selenium can kill bacteria by the catalytic formation of superoxide radicals without leaching out from active surface of material. It is worth noting that selenium is not only less expensive than silver but is also less responsible for causing allergies [4].

From authors' perspectives, chitosan can also be used for developing antimicrobial contact lens and contact lens cases because

of its remarkable antimicrobial activity. Further, it is assumed that due to its non-cytotoxicity, it would not cause any adverse effects on eyes of wearers.

Nevertheless, several antimicrobial compounds are being extensively studied for the development of contact lenses and lens cases as potential alternatives for preventing microbial keratitis caused due to the contamination of contact lenses by different microorganisms including fungus, amoeba, and bacteria. In addition, mode of action of antimicrobial agents to inhibit/kill the said microorganisms can be categorized in several ways such as (i) inhibiting microbial cell wall synthesis, (ii) disrupting or modifying microbial cell wall, (iii) inhibiting protein synthesis (iv) generating reactive oxygen species and so on.

Contact lens case contamination is a significant public health concern. Thus, it causes microbial keratitis in eyes of contact lens wearers. Although patients are aware about the usage of existing contact lens cases, still they are advised to clean and disinfect their lens cases on daily basis.

The contact lens industry has shown tremendous interest in finding new antimicrobial agents apart from silver and selenium for the development of antimicrobial coated contact lens cases to prevent diseases associated with contact lenses. Developing antimicrobial coated contact lens cases, will help reduce exposure to organisms responsible for causing ocular infections, which in turn, will also increase patients' comfort.

However, many aspects of antimicrobial technology as applied to contact lenses and lens cases must be considered for further research. In addition, there is an urgent need for developing contact lens cases using natural antimicrobial compounds provided that they should neither react or leach out into ophthalmic solutions. Finally, it is urged to the contact lens industry to encourage further research towards developing new antimicrobial agents for providing antimicrobial coated contact lens cases as ultimate solution.

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