

Full Length Research Paper

Hygienic condition of multipurpose solutions for soft contact lenses among Saudi Arabian university students

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The use of multipurpose solutions for cleaning and disinfecting soft contact lenses has replaced single purpose solutions. University students in the different Saudi Arabian Universities are permanent customers of the contact lenses wearers. However, the practice of misuse and carelessness in following contact lenses manufacturer instructions is very evident. This study investigated the hygienic condition of two multipurpose solutions with different antimicrobial agents to elucidate the fate of misuse and the expected health complications. Two solutions were selected MeniCare Soft solution from Menicon and ReNu MoistureLoc from Bausch and Lomb. Microbial analysis of the solutions revealed the presence of three bacterial species identified as *Serratia marcescens*, *Klebsiella oxytoca* and *Escherichia coli* and two fungal species were identified *Candida albicans*, and *Malassezia globosa*.

Key words: Contact lens, *Serratia marcescens*, *Klebsiella oxytoca*, *Escherichia coli*, *Candida albicans*, *Malassezia globosa*.

INTRODUCTION

In Kingdom of Saudi Arabia, the number of young people wearing contact lenses has been increasing mainly for correction of myopia and even for cosmetic purpose especially among university female students. Contamination of contact lens care systems are usually regarded as the first step in the pathogenesis of eye infection in lens wearers. More attention should be paid to hygienic maintenance of contact lenses care system for prevention of keratitis (Cohen et al., 1996). Microbial keratitis has been seen in all types of lenses, including rigid gas-permeable lenses, hard or polymethylmethacrylate lenses, and high- and low-oxygen transmissibility soft lenses, as well as with all modes of wear, including daily wear, extended wear, therapeutic wear, and continuous wear (Lim et al., 2002; Donnenfeld et al., 1986). Wearers

of soft contact lenses are at greater risk of developing microbial keratitis than those using other lenses (Smith and McRae, 1989). Lens care solutions in contact lens cases can become concentrated and often form dried films due to evaporation and because these cases are often topped off by users instead of being emptied and then refilled regularly, this could lead to formation of deposits on the lens surface. The propensity of bacteria to adhere to soft contact lenses in areas of deposits has been noted by some authors (Dang et al., 2003).

Currently, multipurpose disinfecting contact lens solutions (MPDS) are the most widely prescribed regimen worldwide. Multipurpose disinfecting contact lens solutions consist of a single solution for disinfecting, rinsing and storing the lenses, with many MPDS having an inherent cleaning agent (McLaughlin, 2001). The main aim of the present study is to analyze the hygienic condition of the left over multipurpose disinfecting soft contact lens solutions utilized by lens wearers among the

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Table 1. Shows the number of isolates cultivated from the MPDS samples. One ReNu MoistureLoc solution sample and two MeniCare Soft solution samples were negative for microbial contamination.

| Microbial species | MeniCare Soft solution | ReNu MoistureLoc solution |
|----------------------|------------------------|---------------------------|
| <i>E. coli</i> | 4 | 2 |
| <i>K. oxytoca</i> | 4 | - |
| <i>S. marcescens</i> | 3 | 5 |
| <i>C. albicans</i> | - | 4 |
| <i>M.globosa</i> | 2 | 3 |

Saudi female university students.

MATERIALS AND METHODS

Lens care solutions

Two most common used MPDS by the students were selected for analysis. MeniCare Soft solution from Menicon contains 0.0001% 1-(diaminomethylidene)-2-hexylguanidine as antimicrobial agent and macroglycerol hydroxystearate 60, glycine, glycolic acid, AMPD and propylene glycol as surfactant, isotonic and buffering agents. ReNu MoistureLoc solution from Bausch and Lomb contains 0.00045% alexidine as antimicrobial agent and poloxamer 407, tetric 1107, boric acid, sodium tetraborate and sodium chloride as surfactant, isotonic and buffering agents.

Sampling

The target groups of students were all female between the ages of 18 to 21 years old. Swabs (rubbing) from the inside of 30 students – owned contact lens cases that contained the remaining contact lens multi-purpose disinfecting solution were collected aseptically. Fifteen for each MPDS were analyzed. All students selected were on daily use of their contact lenses for a minimum of one week.

Bacteria and fungi isolation and identification

Each swab was cultured in Blood Agar, Mac Conkey and Sabouraud's Dextrose Agar media. The former two inoculated media were incubated for 18 – 24 h at 37°C while the later was incubated at 25°C for two weeks. The plates were examined at frequent intervals for developing colonies. Bacterial isolates were identified initially by Gram stain then using the API 20E (BioMérieux, Montalieu Vercieu, France) system. Peptone broth sugar fermentation tests were also used to confirm identification.

Fungi isolates were identified based on colonial, microscopic morphology and physiological properties. However, further tests were used for identification such as Tween assimilation test, catalase reaction and urease reaction (Guého et al., 1996). The Tween assimilation test was performed using a suspension of colonies inoculated into a plate containing Sabouraud agar supplemented with 0.05% chloramphenicol and 0.05% cycloheximide. Each polysorbate (Tween 20, 40, 60 and 80) was added to fill up equidistant wells made in the inoculated agar. The plates were then incubated at 32°C for 5-7 days. After this period, the growth around each well, indicating assimilation of the substrate and a positive result, was observed. As for the catalase reaction was determined by application of a drop of hydrogen peroxide (10 vol.) onto a portion of a colony on a glass slide. The production of gas bubbles indicated a positive reaction.

RESULTS

Three bacterial species were identified as *Serratia marcescens*, *Klebsiella oxytoca* and *Escherichia coli*. The number of isolates per sample is as shown in Table 1. As for the fungi, two strains were identified *Candida albicans*, and *Malassezia* spp. As for *Malassezia* spp glabrous colonies of a creamy-yellow color and a furrowed surface were observed, the reverse of the colony also being creamy-yellow in color. All species of *Malassezia* were urease negative, catalase positive and the assimilation of Tween 40 was absent. The microscopic observation of these yeasts found spherical yeasts giving birth to buds which can lengthen to form very short cylindrical strands. This allows the identification of *Malassezia globosa* (Figure 1).

DISCUSSION

The hygienic parameters needed for the MPDS safe use were not meet by the Saudi female students. Obviously, the microbes isolated are resistant to both antimicrobial agents PHMB and alexidine. The microbial species isolated were either normal commensals of the human body such as *E. coli*, *C. albicans* and *M. globosa* or environmental pathogenic species such as *S. marcescens* and *K. oxytoca*.

This study data is in agreement with those of May et al. (1995), who examined the antimicrobial activities of a number of disinfectant solutions, recommended for use with rigid gas-permeable or hard contact lenses, against planktonic and adhered cells of bacteria and *C. albicans*. Their findings showed that cells of all microorganisms adhering to wells of polyethylene contact lens cases showed various degrees of survival after 4, 6, and 12 h of exposure to most contact lens solutions. Similarly, Wilson et al. (1991) showed that biofilms of *Pseudomonas aeruginosa*, *S. marcescens*, *Staphylococcus epidermidis*, *Streptococcus pyogenes*, and *C. albicans* formed on wells of polyethylene contact lens cases retained viability with certain soft contact lens disinfectant solutions after exposure for the manufacturer's minimum recommended disinfection times.

S. marcescens is an environmental pathogen found in soil and water. *Serratia* species are inherently resistant to

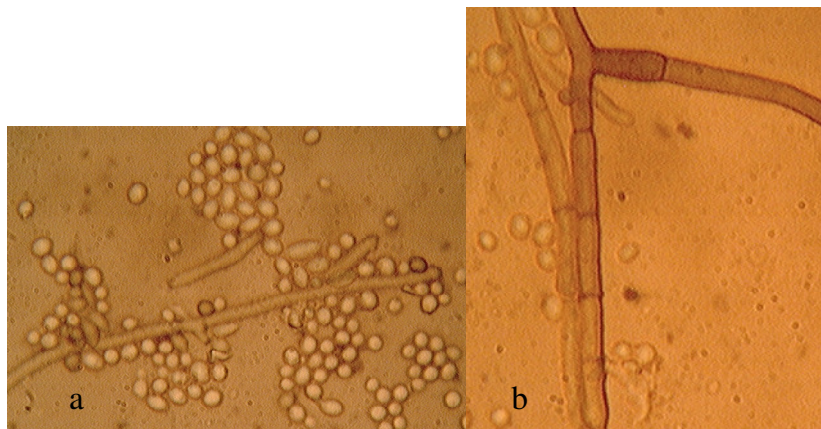


Figure 1. Morphological shape of *Malassezia globosa* fungus (a) Conidia spores, (b) Hyphae.

several antimicrobial agents and is capable of readily acquiring resistance (Mah-Sadorra et al., 2005). Alexandrakis et al. (2000) identified *S. marcescens* as the second most common gram-negative isolate in microbial keratitis and in particular in contact lens-related keratitis where it represents 18% of bacterial infections. Many studies of *S. marcescens* have implicated hand transmission in the spread of this organism (Van Ogtrop et al., 1997; Schaberg et al., 1976; Maki et al., 1973).

Fungal keratitis accounts for 30 - 40% of all cases of microbial keratitis in developing countries (Gopinathan et al., 2002). Risk factors for *Candida* keratitis include: older patient, pre-existing ocular disease, exposure keratopathy, foreign body, corneal surgery, chronic keratitis, chronic use of steroids, and immunosuppressive disease. *C. albicans* keratitis is a challenge for ophthalmologists due to its tendency to mimic other conditions. Frequently, cases are misdiagnosed at initial presentation, resulting in loss of valuable time in treatment. Misdiagnosis may be due to its uncommon occurrence (Sun et al., 2007). Furthermore, the genus *Malassezia* comprises a group of superficial fungi occurring as normal skin flora on the human body around the areas that are rich in sebaceous glands. Rarely, they become invasive and cause opportunistic infections under certain conditions. These conditions include high temperature, high humidity and internal factors such as the long-term use of corticosteroids and immunosuppressants, chemotherapeutic agents, bone marrow transplantation, AIDS, leukemia and diabetes (Wolff et al., 2008). *Malassezia* may play a role in certain cases of chronic blepharoconjunctivitis, either through a reaction of intolerance and hypersensitivity or occasional proliferation (Derbel et al., 2005).

Although *E. coli* was not reported to cause eye infection, yet it commonly contaminates contact lens accessories stored in the bathroom (Boost and Cho, 2005). *K. oxytoca* is a member of the family

Enterobacteriaceae known to be responsible for nosocomial infections and urinary tract infections, respiratory tract infections, surgical wound infections, and also colitis and diarrhea after antibiotic use (Gorkiewicz, 2009; Högenauer et al., 1998; García et al., 1985). Matharoo (2004) reported an endophthalmitis infection caused by *K. oxytoca* to an acute-postoperative case following cataract surgery.

The risk of keratitis is increased by the use of contact lenses. However, levels of infection can be minimized by good compliance with contact lens care routines (Rah et al., 2002; Boost and Cho, 2005). It is important that contact lens care solutions have good disinfection capacities and stability to help minimize development of eye infections.

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