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Evaluation of Eye Drops and Eye lenses contamination

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Abstract

Both medical drops and contact lenses can transfer pathogenic bacteria that are potentially dangerous to the eye if they neglect the safety steps that accompany their use. This research aims to assess the contaminants present in the folds of medical drops and on contact lenses to estimate the degree of risk associated with their use. Out of 125 drops used in the research, the percentage of contamination was 36.8%. The bacteria that were found developing on medicinal drops were the following *Staphylococcus aureus*, negative staph coagulants, *Streptococcus sp*., *Haemophilus influenzae, Bacillus sp*. and *Coliform bacteria.* 100 Lenses were distributed in two groups according to how long they were used. The contamination rate of contact lenses that were used on a daily basis reached 26.6%, while the contamination of contact lenses that were used on occasions only was 29%. It contained the following bacteria *Staphylococcus sp., Streptococcus sp., E. coli, Pseudomonas aeruginosa, Klebsiella* and *Lactobacillus.*

Keywords: Eye drops; Eye lens; Contamination; Ophthalmology; Cornea; Infection; Ocular infection.

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Introduction

It should be borne in mind that eye drops if get contaminated can cause serious complications for people who use them as a treatment [1]. A percentage of the contamination was identified in the samples collected from ophthalmic departments where potential bacteria have been found [2]. Other reported cases include contamination of eye droplets with Serratia bacteria known to cause keratitis in people who have undergone corneal surgery [3]. Cases of endophthalmitis infection have also been recorded which caused by *Pseudomonas pyocyanea* [4-6]. In addition to many cases of contamination in drops used collectively in the clinics where the patients are given from the same bottle to reduce expenses and for delivering medicine to a patient in the best way, however it was found after the study of the safety of sharing eye drops that preservatives used to save medical fluid may lead to finding proper environment for bacteria, in addition to bacteria that can be found on the internal grooves of the droplet [7]. Some studies have shown that there is no significant difference in microbial contamination between droplets taken from different locations, such as droplets used to prepare the patient for surgical operations or droplets used for patients after surgery or droplets used personally by the patient in his home [8-10]. Ophthalmic medication could be contaminated with potential microbes due to multiple uses of this medication or unintentional neglect by exposing it to air or not covering it immediately after completion of use [11]. British Pharmaceutical Codex, along with the British National Formulary, has covered all instructions regarding ophthalmic medication to ensure that they are used in a healthy manner [5,6]. With the increasing emergence and widespread use of soft contact lenses among girls and adolescents, the risk of contagion and bacterial infections has increased [9]. These contact lenses serve as a vector and an agent to inoculate the microscopic organism in the cornea of the eye furthermore with bacterial accumulation in the eye plus the weakness of the internal tissue of the eye can inflammation can reach the cornea or conjunctiva and cause great damage [10]. This study aims to investigate the possibility of eye drops bottles being exposed to microbial contamination after specific periods. It is also intended to assess the potential risk of eye infections due to the frequent use of contact lenses.

Material and Methods

Samples were collected from various hospitals and clinics providing ophthalmology services in Erbil and Duhok cities, Kurdistan region, Iraq. The total number of collected eye drops was 125 can. The samples were collected in sterile bags then delivered to the laboratory where sterile swabs moistened with a normal slain used to wipe the cap of eye drop well then cultured in three types of culture media for bacterial isolation, nutrient agar. Blood agar, and chocolate agar. A drop was also cultured from the residual on the same types of cultural media. Similarly, eye contact lenses were collected from 100 Volunteers; they were asymptomatic; eye lenses were grouped according to how long they have been used. So there were two kinds of samples, one that was used daily and the second that was used only on occasions. Microbial pathogens were diagnosed by standard laboratory protocol.

Result

After examining (125) samples of eye droppers, it was found that (46) of them were contaminated; this represents 36.8% of the total

samples. The number of contaminated covers was (36) drops, which represents a percentage of 78.2%, as well as (15) Contaminated drops the contamination was present in the residual substance, that represent 32.6% of the contaminated drop can. Note that some drops were found to be contaminated in both parts of the cover and the residual substance beneath the drop.

Most of the isolated bacteria were natural flora; *Staphylococcus aureus*, as well as Coagulase-negative staphylococcus, were the most isolated bacteria, *Streptococcus sp*., and *Bacillus sp*., also found with gram-positive bacteria. *Haemophilus influenza* and *E. coli* were also isolated as gram-negative. (Table 2) shows the names of the bacterial isolates and their location on the therapeutic drops, either on the lid or in the residual solution below the can.

All the drops examined for this scientific research were kept in the usual room grades except for olopatadine, which is used to treat eye allergy was kept in the refrigerator. All types of medicinal drops that were examined with Benzalkonium chloride as preservatives in varying proportions, except for dexamethasone, which was free of any preservative (Table 3) shows the proportions of preservatives in each type of medication.

100 Lenses were distributed in two groups according to how long they were used. The first group included lenses that were used daily, including 45 samples collected, of which 21 were found to be contaminated, representing 26.6%. As for the second group, which included lenses that were used only on a few occasions, 55 samples were collected, 16 of which were contaminated, and this represents 29%. (Table 4) shows the distribution of contamination in contact lenses according to the period of use.

From a total of 100 tested contact lenses, 37 were found to be contaminated with one or two bacterial species, while 63 samples were found free from microbial contamination. (Table 5) shows the microorganisms that have been isolated from contact lenses, whether they are in the group as daily or occasional use.

Table 1: Statistical types and numbers of medical drops used in the Department of Ophthalmology.

Medical treatment	No. of Treatment cans	No. of contaminated cans	Covers	%	Residual	%
Gentamycin	40	16	12	75%	4	25%
Fluorometholone	35	12	11	91.6%	2	16.6%
Ofloxacin	20	8	7	87.5%	4	50%
Olopatadin	18	6	4	66.6%	2	33.3%
Dexamethason	12	4	2	50%	3	75%

Table 2: Bacterial isolates and their location.

Bacterial Sp.	Caps	Residual
Staphylococcus aureus	P	P
Coagulase negative staphylococcus	P	0
Streptococcus sp.	P	0
Haemophilus influenzae	0	P
Bacillus sp.	P	0
E. coli	P	P
*P: Present in bacterial growth, *0: Not present		

Table 3: The proportions of preservatives in each type of medication.

Medical treatment	No. of Treatment cans	No. of contaminated cans	Preservative	Preservative Ratio
Gentamycin	40	16	Benzalkonium chloride	0.02%
Fluorometholone	35	12	Benzalkonium chloride	0.004%
Ofloxacin	20	8	Benzalkonium chloride	0.005%
Olopatadin	18	6	Benzalkonium chloride	0.01%
Dexamethasone	12	4	Preservative free	/

Table 4: Shows the distribution of contamination in contact lenses according to the period of use.

Duration of use	No. of total samples	No. of contaminated samples	Percentage of contamination
Daily use	45	21	26.6%
Occasionally use	55	16	29%

Table 5: Shows the microorganisms that have been isolated from contact lenses.

Isolated organism	No. of samples	Percentage
Staphylococcus sp.	16	43.2%
Streptococcus sp.	8	21.6%
E.coli	6	16.2%
Klebsiella	4	10.8%
Lactobacillus	4	10.8%
Pseudomonas aeruginosa	2	5.4%

*The appearance of the cumulative percentage more than 100% is due to the presence of more than two types of bacteria in some samples. All samples subjected to the study contained Polyhexanide as a preservative with a rate not exceeding 0.0001%

Discussion

The occurrence of this type of contamination in the medicines used to treat the eye is of great concern to the ophthalmologists. The presence of this type of contamination may lead to the emergence of minor allergic symptoms to serious bacterial and fungal keratitis. Preservatives are mandatory in ophthalmic medications, one of which is Benzalkonium chloride (BZK), which has detergent in addition to quaternary ammonia to prevent bacterial aggregation on the eye. However, continued exposure to these preservatives may lead to the continuation of inflammatory processes and enhance the toxic effect on the cells of the cornea [12]. Pathological consequences have been established for users of contaminated drops, especially patients with conjunctiva who use eye medications, which were more acceptable to develop contamination with serious pathogens [13].

The rate of contamination that appeared in the current study, which reached 36.8%, is high compared to similar scientific studies, which ranged between 6.1-11.7% [14]. This may be due to prolonged use because the pharmaceutical cans used in other scientific research were limited to very short periods of no more than one week in addition to the possibility of a difference in the way the cans are preserved.

Most of the isolates were gram-positive bacteria, both *Staphylococcus aureus* and Coagulase-negative staphylococcus considered Normal Flora. Do not cause infections as long as they remain outside the body, but if they exist in large quantities or if they enter the bloodstream then it will be able to cause different types of infection [15].

Streptococcus sp. is a common cause of corneal ulcer infections, conjunctivitis, dacryocystitis, and endophthalmitis. Scientific research reported that it represents 43% of the causes of eye ulcers and 34% of the endometriosis [16]. Colonization of *Haemophilus influenzae* the upper pharynx affects the occurrence of eye inflammation. Some patients were found to have upper respiratory tract infections in conjunction with eye inflammation [17]. The first bacterial infections of the eye with

gram-positive bacilli were recorded in 1890. Since then, many other infections have been recorded as being caused by gram-positive bacilli [18]. The presence of such bacteria in eye drops is a high-risk indicator as endophthalmitis with bacillus bacteria may lead to loss of vision within several days [19].

E. coli was observed in neonatal conjunctiva by no more than 2.8%. Some scientific research also reported its presence as a contaminant of drops used for treatment in ophthalmology [20]. As for the contact lenses that were classified into two groups, the first included the used lenses daily, and it became clear that their contamination rate is much greater than that of the second group, which included the lenses used in occasions only. This shows that users are less interested in cleaning and decontaminating their lenses. This 71% result is a close approximation to what similar scientific research has shown, including Thakur D, et al (2014) saying it is 74% and Lipener C, et al. (1995) 86.6% [21,22]. The most important reason for contact lens contamination is that it contains a high percentage of water that collects debris, especially bacteria. The chronic stress resulting from long contact with the lens leads to a lack of oxygen, this entire works to attract serious ocular infection [23] the appearance of gram-positive streptococci is a highly dangerous indicator as it is known to cause poor eyesight and pain within five days of being injected with the eye [24]. Lactobacillus, a Gram-positive bacterium that has Bacillus-shaped bacteria, has been found in high levels in the eyes of people who are used to wearing contact lenses [25]. Other bacteria which are gram-negativee bacilli are regarded as highly polluting bacteria. Polyhexanide is a sterile disinfectant polymer known to have a broad effect on bacteria; the bacterial cell loses its essential components due to the great damage it causes to the cell membrane [26].

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