

SYSTEM FOR THE CARE OF CONTACT LENSES

The invention relates to an apparatus for the maintenance and care of contact lenses as claimed in the preamble of patent claim 1.

An apparatus of this kind, known in the art from DE 196 24 095 C1, envisions a container with a 3% solution of H_2O_2 for the maintenance and care of the contact lenses, in particular for disinfecting the contact lenses. The contact lens is immersed in this solution for treatment and storage. A platinum film is brought onto a formed piece of glass to neutralize the aqueous hydrogen peroxide solution; a platinum film can also be envisioned as inside coating of the container which is made of glass.

Aside from the disinfecting effect, maintenance and care of contact lenses also require anti-microbial and anti-viral effectiveness as well as sufficient preservation, in particular if the contact lens is kept in the maintenance and care solution for an extended period of time, as is the case, for example, with adaptive contact lenses (DE 196 01 568 A1).

The oligodynamic effect, i.e. the growth-inhibiting or killing effect of heavy metals, in particular that of silver, with regard to microbes is known in the art. However, it has become evident that if silver (silvering) is used in the usual fashion in



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connection with the maintenance and care system referred to at the outset, the life of the platinum catalyst becomes compromised. The platinum film catalyst needs replacement after only a short period of time.

Therefore, it is the subject-matter of the invention to provide a device of the kind referred to at the outset that will ensure both the oligodynamic effectiveness of the maintenance and care system as well as the long life of the platinum film catalyst.

This objective is achieved according to the invention by way of the characterizing features in patent claim 1.

The invention relies on the realization that the life of the platinum film catalyst is not negatively affected if the total silver surface, which becomes active in the hydrogen peroxide solution, does not exceed an upper limit. This upper limit is in the order of magnitude of 30 mm²/ml of the H₂O₂ solution that is filled in the container. Preferably, the aqueous H₂O₂ solution is a physiological solution with a physiological pH value (of approximately between 6 and 8). The desired anti-microbial long-term effectiveness is achieved in this solution as well, preferably, using the uniform silver metal film on a support piece. In the disinfecting phase (2 to 6 hours) an inoculation with 10⁵ to 10⁶ KBE/ml of the test germs prescribed by the

international standard draft [specification] ISO/DC 14729 (pseudomonas aeruginosa, staphylococcus aureus, serratia marcescens, candida albicans and fusarium solani) as well as with aspergillus niger was effected. No growth was found at the end of the disinfecting phase, or a germ reduction of at least a factor of ten (5 log) was determined. After inoculating with poliovirus, a reduction to below the detection limit resulted within 60 minutes. After inoculating with adenovirus, within 120 minutes a > 3 log reduction resulted; after 240 minutes, a >4.5 log reduction (virus below the detection limit) was obtained. After an inoculation with the HSV 1-virus, a > 3 log reduction (virus below detection limit) occurred within 30 minutes.

As a result, a single-stage system is created for the disinfection and preservation of contact lenses which is very effective during the disinfection and, during the storage of contact lenses, ensures (prevents? translator) their microbial contamination without the use of preservatives.

In a preferred manner, a silver surface is used of approximately 0.2 to 0.6, particularly 0.3 mm²/ml, of the hydrous H₂O₂ solution (3%) charged into the receptacle.

The silver layer with the indicated surface can be provided on a contact lens hold-down device by means of which

the contact lens is immersed in the solution. This hold-down device can in a known manner be provided on the underside of a closing cover by which the receptacle is covered. By means of the hold-down device, it is prevented that, as a result of the gases forming during the contact lens care and the neutralization of the care solution, the contact lens to be treated is driven to the surface of the care solution, but remains constantly immersed in the care solution.

The system for the care of contact lenses can be constructed as described in German Patent Document DE 197 57 356.8 A1. In this case, the receptacle, which receives the hydrous H_2O_2 -solution and the contact lens, can consist of glass and be coated on its interior side with a platinum layer catalyst. The platinum layer can be applied by sputtering. However, it is also possible to provide a molded body made of glass, which is provided with a platinum layer, in the receptacle (German Patent Document DE 196 24 095 C1). The silver layer will then preferably be situated on the contact lens hold-down device which is provided with bores so that the care solution will be present also over the hold-down surface which is immersed in the solution.

In another embodiment, the contact lens hold-down device can consist of glass, on one side of the hold-down device, particularly the underside, the platinum layer being arranged

which is preferably applied by sputtering, and on the other side, particularly the top side of the hold-down device, the silver layer being arranged which can also be applied by sputtering. The receptacle can then also consist of plastic.

The invention will be explained by embodiments by means of the drawings.

Figure 1 is a view of a first embodiment; and

Figure 2 is a view of a second embodiment.

In the two embodiments of Figures 1 and 2, two cup-shaped receptacles 1, which are liquid-tight, are arranged in a case 4 in two receiving compartments 5 of the case. Each receptacle is used for receiving and for the care of a contact lens. On the exterior side of each receiving compartment 5, a thread is provided at the upper edge of the case 4, onto which thread a cover 3 can be screwed. However, it is also possible to provide a different holding device for the cover on the case, such as a clip-on device, holding clamps, or the like. As a result, a liquid-tight connection is established between the cover and the case. Inside the receiving compartments 5, the respective receptacles 1 are held at a distance from the cover underside and from the interior side of the respective receiving compartment 5. As a result, a space or spaces

is/are created between the respective upper edge 6 of the receptacle and between the respective exterior side of the receptacle and the interior side of the respective receiving compartment 5, which space or spaces form(s) a passage for gases which are formed in the respective receptacles during the contact lens care. At the respective case 4, a bottom is provided on the underside. The case preferably consists of plastic. The bottom may consist of plastic, particularly of metallized plastic, or of metal. As described in German Patent Document DE 197 57 356.8, the bottom may be fastened to the case 4 in a removable manner, for example, by means of a snap-on connection. As a result, it is ensured that gas, which is formed during the care of the contact lenses and during their storage in the receptacle, can escape through the created spaces.

In the illustrated embodiments, one hold-down device 6 respectively is provided. The hold-down device 6 has a hold-down surface which is immersed in the charged care solution. The care solution consists of a 3% H_2O_2 -solution. As a result of the effect of this care solution, the immersed contact lenses are disinfected. In order to avoid hydrogen peroxide residue on the contact lenses after the care, as a result of the effect of a platinum layer 2, the hydrogen peroxide is decomposed into oxygen and hydrogen (neutralized).

In the embodiment of Figure 1, the platinum layer 2 is situated on the interior side of the receptacle 1 consisting of glass. On the hold-down device 6, a silver layer 7 is situated which, similar to the platinum layer 2, can be applied by sputtering to the top side of the hold-down device 6. The hold-down device 6 has bores, so that the care solution can penetrate through the hold-down surface and it is ensured that the contact lens immersed by the hold-down surface will be situated below the surface of the charged care solution. The applied silver layer 7 is also always situated within the filling volume of the charged care solution. As a result, an oligodynamic effect of the solution is achieved during the disinfection phase, in which the hydrogen peroxide has an effect, as well as after the neutralization of the hydrogen peroxide solution.

In the embodiment of Figure 2, the platinum layer 2, which acts as a neutralization catalyst, is situated on the underside of the hold-down device 6. The silver layer 7 is situated on the top side of the hold-down device 6. In this embodiment of Figure 2, the hold-down device 6 is made of glass. The silver layer 7 is preferably produced by sputtering. The surface of the silver layer 7, which is in contact with the H_2O_2 -solution, amounts to maximally 30 mm²/ml, relative to the filling volume of the H_2O_2 -solution. In the embodiment of Figure 2, the receptacle 1 may consist of glass

or of another material, such as plastic.

Instead of the hold-down device 6, small baskets can be used which are each provided on the underside of the cover 3 and carry the silver layer 7. The hold-down device and the small storage basket ensure that the contact lens is always immersed in the care solution. Gases forming during the neutralization and care cannot drive the lens to the surface of the care solution. As a result, a constant care of the immersed contact lens is achieved.

In the following Tables 1 and 2, the oligodynamic effect of different embodiments of the care system is illustrated in the case of various test organisms. In this case, neutralized hydrogen peroxide solutions (isotonic, pH 6.5, < 5 ppm residual content of hydrogen peroxide) are inoculated with approximately 10^6 microorganisms per ml of solution. Based on the tables, also in the case of relatively small silver layer surfaces (between 0.15 and 2.0 mm²/ml), the oligodynamic effect occurs which is achieved over a fairly long time period, which effect is important particularly for the care of adaptation (soft?) contact lenses.

Translation of Tables

Testorganismus	test organism
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Ag-Oberfläche	Ag surface
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Ausgangs-Inokulum	initial inoculum
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Logarithmische Reduktion der Testmikroorganismen =
 logarithmic reduction of test microorganisms

Ausgangs-KBE	initial KBE
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Stunde	hour
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Stunden	hours
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Tage	days
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Durchschnittswert einer Doppelbestimmung =
 average value of a repeat determination

KBE: Anzahl der koloniebildenden Einheit =

KBE: Number of the colony-forming unit

n.g.: kein Wachstum	n.g.: no growth
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List of Reference Number

- 1 Receptacle
- 2 platinum layer
- 3 cover
- 4 case
- 5 receiving compartments
- 6 hold-down device
- 7 silver layer
- 8 bottom

CLAIMS

1. Apparatus for the maintenance and care of contact lenses consisting of a container, an aqueous H_2O_2 solution, that can be filled into or is filled in the container, and a catalyst comprised of a platinum film, whose surface is in contact with the aqueous H_2O_2 solution wherein a silver layer (7), deposited on a support piece, is also in direct contact with the aqueous H_2O_2 solution that is filled in the container (1), in particular the silver layer (7) is in contact with a surface that is less than approximately 30 mm²/ml.

2. Apparatus as claimed in claim 1 wherein the silver layer (7) is envisioned on a holding-down device (6) that immerses the contact lens in the H_2O_2 solution.

3. Apparatus as claimed in claim 2 wherein the holding-down device (6) is envisioned on the bottom side of a closing lid (3).

4. Apparatus as claimed in one of the claims 1 to 3 wherein the silver layer is envisioned on the one side of the holding-down device (6) and the platinum layer (2) is envisioned on the other side of the holding-down device (6), and wherein the holding-down device (6) consists of glass.

5. Apparatus as claimed in one of the claims 1 to 4 wherein the aqueous 3% H_2O_2 solution is a physiological solution.

6. Apparatus as claimed in one of the claims 1 to 5 wherein the 3% H_2O_2 solution has a pH value of approximately between 6 and 8.