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STUDIES AND RESEARCH ON THE INFLUENCE OF CLEANING PRODUCTS ON THE SURFACE QUALITY OF OCULAR PROSTHESES

Antonia DINESCU, Beatrice TUDOR
"Dunarea de Jos" University of Galati, Romania
e-mail: beatrice.tudor@ugal.ro

ABSTRACT

The paper presents a study on the influence of different cleaning products on the quality of ocular prostheses. For cleaning, tap water, still water, chlorhexidine and artificial tears were used. The pH of the cleaning solutions was determined and a microscopic analysis of the surface of the samples was performed to observe how the solution used and the method of drying the prosthesis, respectively, air drying or wiping with a napkin, influenced the quality of its surface.

KEYWORDS: ocular prosthesis, cleaning solutions, surface quality

1. Introduction

Ocular prosthesis is a preferred method in cases where one eye has lost its natural appearance. The ocular prosthesis is custom-made, based on the colour of the person's other eye [1, 4].

Proper care of the ocular prosthesis ensures a healthy cavity and increases the lifespan of the prosthesis.

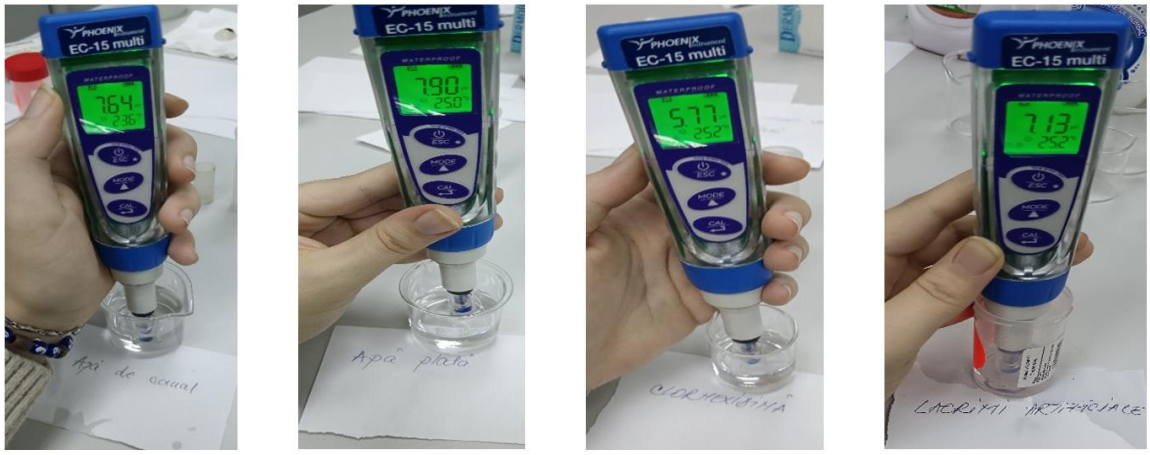
Ocular prostheses require special maintenance because they are in direct contact with the patient's anatomical areas and bodily fluids. The maintenance of such a prosthesis requires very rigorous hygiene because the patient is exposed to daily atmospheric pollution [2].

Over time, the surface of the ocular prosthesis collects proteins and impurities. Proper care ensures a healthy orbit and increases the lifespan of the prosthesis.

2. Experimental procedure

Several cleaning solutions, plain water, tap water, chlorhexidine and artificial tears were studied and their pH was measured (Figure 1).

The data obtained for the pH of cleaning solutions are presented in Table 1.



a b c d

Fig. 1. *pH determination: a) tap water, b) still water, c) chlorhexidine, d) artificial tears*

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Table 1. *Physical properties of cleaning solutions used in experimentation*

Determinations	Tap water	Still water	Chlorhexidine	Artificial tears
pH	7.6	7.9	5.7	7.1
Conductivity	-39.7 mV	-62.0 mV	-71.2 mV	-11 mV
Salinity	608 mg/L	142,4mg/L	3,3 g/L	7 mg/L

Chlorhexidine, compared to other solutions, has an acidic pH. In this case, it is used for cleaning, which can damage the acrylic layer, and is recommended only if the eye cavity presents certain inflammations and requires a deeper cleaning [3].

The highest pH was found in tap water, as it is considered strongly alkaline, due to the presence of bicarbonate ions in the aquifer.

Tap water has a pH of 7.64 and a salinity of 608 mg/L, which makes it not recommended.

The most effective and neutral cleaning solution is artificial tears.

The use of alcohol and abrasive detergents can cause permanent and irreparable damage to the surface [5].

3. Microscopic study of the surface quality of ocular prostheses

The microscopic analysis of the surface of the prostheses was performed using the KERN optical microscope assembly, consisting of a computer and a monitor (Figure 2).

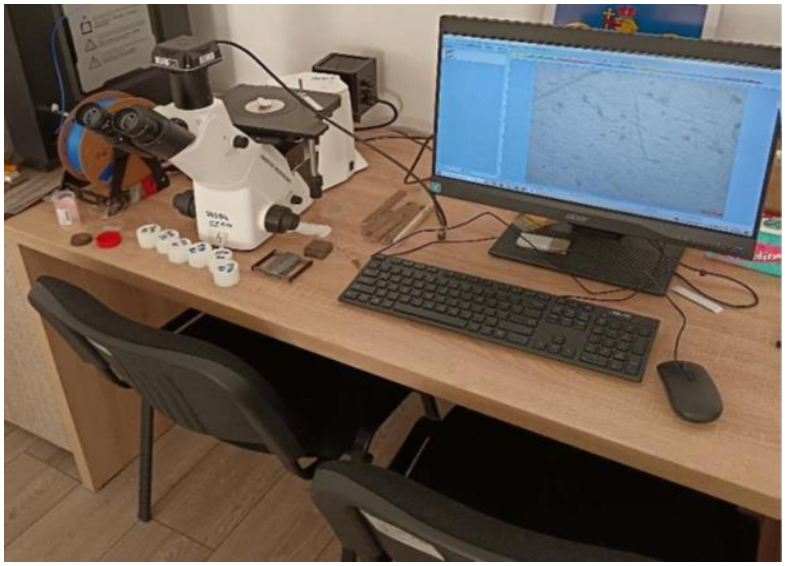

Fig. 2. *The optical microscope, model KERN*

The 50 W halogen unit ensures optimal illumination of the samples.

The technical data of the KERN optical microscope are:

- Infinite optical system;
- Five-position relay;
- 30° inclined viewing position;
- Diopter compensation on both eyepieces;
- Dimensions: L×W×H: 747×271×379 mm;
- Net weight approx. 12.968 kg.

The surfaces of the samples, including the control sample, the sample after air drying, and the sample dried with a napkin, were analysed under a microscope.

The image obtained under the optical microscope of the ocular prosthesis surface, before being subjected to research, is presented in Figure 3.

The sample after using the cleaning solution was dried and studied under the optical microscope.

First, the sample was dried in air, then analysed under the microscope, (Figure 4a). The sample for which a napkin was used for drying is shown in Figure 4b.

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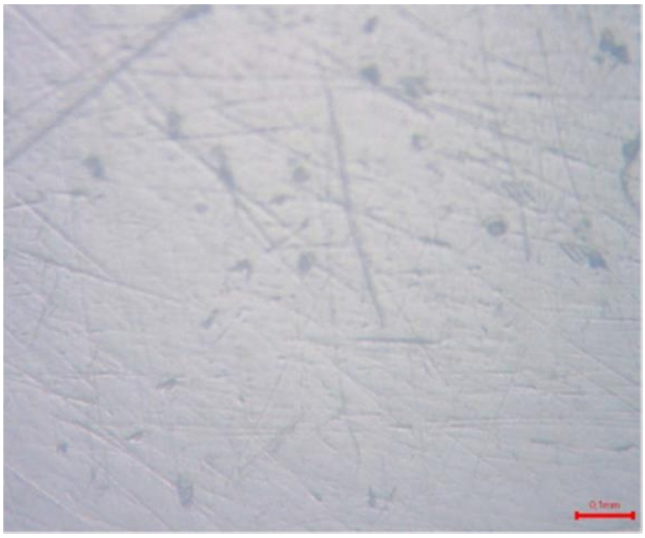
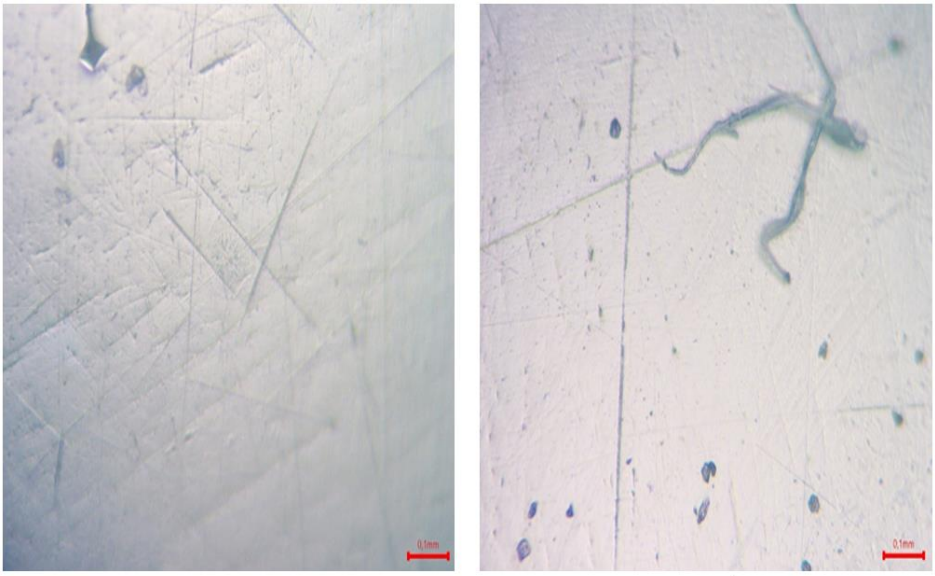


Fig. 3. *Surface of the initial sample, 100x magnification*



a b

Fig. 4. *a) Air-dried sample, b) Tissue-dried sample*

From the point of view of surface quality, it is observed that the air-dried sample shows fewer scratches on the surface, while the sample dried with a napkin showed a more pronounced deterioration in surface quality, as well as adhesions of cellulose fibres on the surface of the prosthesis.

Following this study, artificial tears and air-drying are recommended for cleaning the ocular prosthesis.

4. Results and Discussion

Studies and recommendations on ocular prosthesis maintenance solutions have also been conducted by Osborn and Hettler. According to them, the recommended cleaning agents are mild soap, baby shampoo, and a hard contact lens cleaner.

In this paper, the study was based on measuring the pH of the cleaning solutions and performing a microscopic analysis of the ocular prosthesis surface to assess the quality of its surface after the use of these solutions.

The prosthesis surface was also analysed microscopically based on the drying method used after cleaning - specifically, drying with a tissue versus air drying.

Regular tap water should be avoided, as it is a potential source of contamination. Alcohol and

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abrasive cleaning products should not be used, as they can cause permanent and irreparable damage to the prosthesis surface [5].

5. Conclusions

The study of the influence of cleaning products on the quality of ocular prostheses, as well as their maintenance method, was done by determining the pH of some products for cleaning and maintaining prostheses, namely plain water, tap water, chlorhexidine and artificial tears.

The highest pH was obtained with still water, because it is considered strongly alkaline, due to the presence of bicarbonate ions in the aquifer.

Tap water has a pH of 7.64 and a salinity of 608 mg/L, which does not make it recommended.

The most effective and neutral cleaning solution is artificial tears.

The use of alcohol and abrasive detergents can cause permanent and irreparable damage to the surface of the prosthesis.

The microscopic analysis of the surface of the ocular prosthesis was performed using a KERN optical microscope in order to observe changes in the quality of the surface following the use of cleaning products.

After microscopic analysis, in terms of surface quality, we observe that the air-dried sample obtained a less scratched surface, while the tissue-dried sample showed a more pronounced deterioration in surface quality and adhesion of fibres from the tissue to the surface of the prosthesis.

It is recommended to dry the ocular prosthesis outdoors.

The longevity of such a prosthesis can last from 2 to 6 years, depending on the patient's age, occupation (job) and care for it.

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