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DISINFECTION OF PRINTS IN PROSTHETIC DENTISTRY. MAIN TRENDS IN SOLVING THIS PROBLEM

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Abstract. *Conducted a content analysis of the problem of disinfection of dental impressions found that currently, in the conditions of significant growth the incidence of viral hepatitis B (HV) and AIDS, the problem of disinfection of impression materials in dentistry is especially important. Researches of impression disinfection methods and the search for effective disinfectants (D), with high activity, but does not affect the properties of impression materials, and thus the accuracy and quality of the models is being conducted. Review of the literature about the subject shows that there is no consensus on the effectiveness of the use of different groups of (D), there is no evidence-based recommendations for the disinfection of different impression materials. Questions about disinfection of impressions in prosthetic dentistry are not developed enough. The need for further research in this area is obvious. Further research on how to improve the disinfection of impressions in prosthetic dentistry should be focused on the study of disinfection process during manufacturing of materials (production level) and clinical laboratory stage of impressions manufacturing (clinical and technological level).*

Keywords: *sterilization, decontamination, disinfectants, dental impressions, impression materials.*

Significant growth of infectious diseases around the world requires a more careful study of ways of spreading infection. Increased risk of its transmission in dentistry due primarily to the fact that the highest concentration of AIDS virus and hepatitis found in the saliva and other secretions [1, 2]. Infectious diseases have always been a hazard for dentists who have regular contact with the blood and saliva of patients during their work. This applies mostly to the hepatitis B virus and AIDS. [3] That's why the problem of disinfection and sterilization in dentistry is especially important.

The aim of this work was the carrying out problem-oriented analysis of the promising ways to improve the disinfection impressions in prosthetic dentistry.

Materials and Methods of research: materials were the primary sources of library fund of Kharkiv Scientific Medical Library, Information Fund of HNMU scientific library, as well as the results of their research of physical and chemical properties of alginate impression materials. The method of decomposition the problem, structural and targeted planning, laboratory methods for the study of the physico-chemical and technological properties of the impression of dental materials were used in the study. This research was done as part of the research program of the Kharkiv National Medical University on the problem: "Complex treatment of patients with pathology of the maxillofacial region."

Discussion of the results of the study. Dentists are a group of professional high-risk for HV and AIDS [4, 5, 6, 7, 8, 9, 10]. Thus, according to the researchers, the incidence of HV in the Polish dentists significantly higher (13.6%) than control patients (7.4%) and nurses (5.3%), with 62% of dentists and 50% of their assistant HV is a professional disease [11]. The risk of HV in dentists is 3.6 times higher than that the other physicians [12]. Increased professional risk of dentists and dental

office staff health explained by the fact that the highest concentration of AIDS virus and HV detected in the blood and saliva [13, 14, 15].

Also, cannot exclude the presence of other pathogenic oral microorganisms: Bacteria tuberculosis, influenza virus, herpes, rhinoviruses, gram negative bacteria, fungi, etc. [16, 17]. The number of microorganisms in saliva ranges from 10^5 to 10^{10} in 1 ml, including up to 50% can be represented by the pathogenic flora [18]. Prints in contact with blood and saliva, can be a source of infection for dentists, nurses, dental technicians and patients [19, 20, 21, 22]. The number of microorganisms on one print is about $1.14*10^8$. The main difficulties in disinfecting impressions are that the applicable methods and disinfecting agents should have a high activity. At the same time, they should not affect the properties of the impression material, the accuracy and quality of prints produced on the plaster models, and have no adverse effects on the operating personnel [28, 29].

Disinfection may be performed by physical and chemical agents [30]. Possibilities of application of physical facilities for disinfection impressions are very limited, mainly due to the vulnerability of impression materials to the effects of factors such as high and low temperature, drying, irradiation, etc. According to the authors, the use of the autoclave can cause destruction of the plaster; gas sterilization - expensive and time-consuming method. The most appropriate method of disinfection the plaster impressions is microwave irradiation. However, it has been found that this method is ineffective against spore-forming bacteria, and it has not been tested against viruses [31, 32]. The ability to use UV radiation to disinfect impressions with a special camera radiating ultraviolet rays with a wavelength of 254 nm is studied in the experiment [2]. Irradiation polysulfide impressions of the material showed a decrease of bacterial contamination, especially in combination with thorough washing with water. However, the authors have not concluded a reliable disinfection of impressions by using ultraviolet rays, they did not study their impact on the properties of the impression material. Gamma-rays is also not widely used to disinfect impressions [33, 34].

At the present time offered various chemical disinfectants used by method of immersion (dipping), spray (irrigation) and in the form of an aerosol. According to several authors broad spectrum of antimicrobial activity possess disinfectants (D) on the basis of chlorine, formaldehyde, glutaraldehyde (GA), phenol, iodophor and some other groups [35, 36, 37, 38, 39, 40, 41, 42].

Efficiency (D) of these groups studied in the prints of the hydrocolloid material (alginate), when vesicular stomatitis virus was applied on the prints [38]. It is found that the virus was inactivated by GA 2% for 1 minute, by 0.5% sodium hypochlorite for 3-10 minutes in the application (D) by immersion or as an aerosol. Immersion of impressions in the iodophor solution for 3-10 minutes, resulted in complete inactivation of the virus, and phenol-based solutions are not effective enough. At the same time, the use of (D) as an aerosol recognized insufficiently reliable [38, 43]. However, exposure data sets (D) as an aerosol or spray for 10 minutes, it was recognized quite effective against bacteria and fungi by treatment of impressions polysulfide, polyester and silicone materials [36]. But virucidal activity used in this work disinfectants on the basis of GA, chlorophenol, iodophor, phenylphenol and phenol-sodium for a given exposure and method of application is not clear. In addition, the use of such an aerosol (D) is unsafe because of the possibility of inhalation poisoning medical personnel [38, 43].

High reduction of microorganisms in the prints of the alginate materials (Calcinatum for example) obtained by immersing them for 5 minutes in a 0.5% solution of paracetic acid [1]. For disinfection of plaster impressions proposed usage of formaldehyde vapor for 60 minutes in a dessicator [1]. At the same time in this research work carried out only on the bacteria, which may be less resistant to (D) than viruses.

Thermoplastic impression material in a state of hydrocolloid can also be a source of bacterial cross-contamination. Iodoform disinfection by softening in water, containing iodoform diluted 1:213, prevents the growth of microorganisms [32].

(D) unequally affect the properties and quality of the various groups of impression materials. Most important to save the accured size of the model and the quality of the surface. As the most effective disinfection method for the majority of impression materials, except for polyester, we recommend 10-hour soaking in 2% GA solution [12]. The British Dental Committee recommends thoroughly wash prints with water and then immerse them in a 2% GA 4 hours [44]. According to the authors, the sterilization impressions for 16 hours in a 2% GA polyester material significantly swell, silicone and polysulfide materials provide a shrink of 0.3-0.4% (but was not any differences between the disinfected and control samples), polyvinylsiloxane impressins not changed [12]. Stable size of the polyvinylsiloxane impressions alsonoted by immersing them for 30 minutes in iodophor solutions and GA [45].

Was found a slight change in the size plaster models made for reprints of polysulfide (Permlastic), polyester (Impregnum) and silicone (Reprosil) materials after their immersion for 10 and 15 minutes in a solution of iodophor, sodium hypochlorite and neutral GA or applying (D) Vogah, Sterall, Biocide, Multicide, Sporicidin by spraying for 10 minutes [36, 39].

Wasn't detected deformation of elastomeric impressions after exposure for 10 minutes with 0.5% sodium hypochlorite, iodophor 0.0075%, 2% GA [46]. There was also no significant difference with the fit of the gold tabs formed from wax models produced by polysulfide impressions disinfected by immersion for 30 minutes in a solution, and control samples [40].

In works [41, 42], it is recommended to immerse silicone prints for 60 minutes in a solution of 2% sodium hypochlorite, prints of composite material Ultrafine (combination of silicone and alginate) up to 60 minutes in a 2% GA, and prints of hydrophilic silicone materials such as the Exaflex aslo up to 60 minutes in 2% GA. But it is recommended to take into account the expansion of the material occurs at 0.03%, and compensate the appropriate material model or simulation.

Big problem is the disinfection of the impressions made of irreversible hydrocolloid materials [13, 25, 43, 47]. Alginate materials are quite popular in dentistry all over the world because of the low cost, ease of use and accuracy of the models. However, they swell and lose dimensional accuracy in the disinfectant solutions. This was discovered during their immersion for 60 minutes in a 2% GA, by immersing for 10 minutes a solution of formalin and sporicidin [39, 41, 42].

However, there are reports that alginate impressions of Xantalgin and Palgat not changed their dimensions under the influence 0.2% of peracetic acid and 2.5% GA solution by immersing them in solutions for 10 seconds and subsequent storage in a dessicator for 5 minutes [43]. When applying isopropyl alcohol appeared depending on the concentration dimensional changes to 0.2 mm, which can be explained by the surface dehydration.

One method of disinfecting alginate impressions - antimicrobial additive component in alginate powders [13, 27, 44]. At the same time it should not be toxic, irritating the mucous membrane, gustatory and olfactory receptors, have harmful effects on the physical and mechanical properties of impression materials. Reprints must acquire at the same time short-term (until the modeling) antimicrobial properties.

The inclusion of the chosen (D) (disinfectant is not indicated) in the alginate powder is allowed to make print microbiologically safe after 10 minutes after its preparation. [44] Testing was carried out only against bacteria and fungi of the genus Candida. Other studies evaluated the new alginate impression material ASEPT Blueprint, containing an antiseptic, unlike conventional Blueprint material [13]. It was shown that the new material provides a higher level of disinfection than Blueprint, treated for 1 minute in a 1% solution Hicalini.

We have investigated the possibility of disinfecting the alginate impression materials Ypeen-Premium and Stomalgin-04 with sodium hypochlorite solution. Was found expressed destructive effect of chlorine based (D) on the foregoing prints of alginate impression materials at a concentrations of sodium hypochlorite 0.1-0.8% , and the exposure time of 1 minute to 1 hour. Therefore, usage of this method of disinfection for these materials is impossible. However, alginate materials we disinfected by Cidex solution (Johnson and Johnson) [48].

Also, we made researches on the usage of peroxide K-30 as part of an alginate impression material to impart decontamination properties [49]. Was developed formula of new alginate impression material "Stomalgin-05" and carried out its complex assessment on our proposed method [50]. The results of our research allow us to recommend "Stomalgin-05" with decontamination properties in the clinic of orthopedic dentistry.

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