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The effect of disinfectants on dimensional stability of addition and condensation silicone impressions

Uticaj dezinficijenasa na dimenzionalnu stabilnost otisaka izrađenih od adicionih i kondenzacionih silikona

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Abstract

Background/Aim. Dimensional stability and accuracy of an impression after chemical disinfection by immersion in disinfectants are crucial for the accuracy of final prosthetic restorations. The aim of this study was to assess the deformation of addition and condensation silicone impressions after disinfection in antimicrobial solutions. **Methods.** A total of 120 impressions were made on the model of the upper arch representing three full metal-ceramic crown preparations. Four impression materials were used: two condensation silicones (Oranwash L – Zhermack and Xantopren L Blue – Heraeus Kulzer) and two addition silicones (Elite H-D + regular body – Zhermack and Flexitime correct flow – Heraeus Kulzer). After removal from the model the impressions were immediately immersed in appropriate disinfectant (glutaraldehyde, benzalkonium chloride – Sterigum and 5.25% NaOCl) for a period of 10 min. The control group consisted of samples that were not treated with disinfectant solution. Consecutive measurements of identical impressions were realized with a Canon G9 (12 megapixels, 2 fps, 6x/24x), and automated with a computer Asus Lamborghini VX-2R Intel C2D 2.4 GHz, by using Remote Capture software package, so that time-depending series of images of the same impression were obtained. **Results.** The dimensional changes of all the samples were significant both as a function of time and the applied disinfectant. The results show significant differences of the obtained dimensional changes between the group of condensation silicones and the group of addition silicones for the same time, and the same applied disinfectant ($p = 0.026$, $F = 3.95$). **Conclusion.** The greatest dimensional changes of addition and condensation silicone impressions appear in the first hour after their separation from the model.

Key words:
dental impression materials; silicones; disinfectans; dental prosthesis.

Apstrakt

Uvod/Cilj. Dimenzionalna stabilnost i preciznost otiska posle hemijske dezinfekcije potapanjem u dezinficijens predstavljaju osnovu za preciznost definitivnih zubnih nadoknada. Cilj ovog istraživanja bio je da se proceni dimenzionalna stabilnost otisaka izrađenih od adicionih i kondenzacionih silikona posle dezinfekcije u antimikrobnim rastvorima. **Metode.** Napravljen je uzorak od 120 otisaka, dobijenih otiskivanjem modela gornje vilice sa ispreparisanim zubima za metalokeramičke krune. Od otisnih materijala korišćena su dva kondenzaciona silikona (Oranwash L – Zhermack i Xantopren L Blue – Heraeus Kulzer) i dva adiciona silikona (Elite H-D + *regular body* – Zhermack i Flexitime *correct flow* – Heraeus Kulzer). Odmah po odvajanju od modela, otisci su potopljeni u odgovarajući dezinficijens (glutaraldehid, benzalkonijum-hlorid – Sterigum i 5,25% NaOCl) u trajanju od 10 min. Kontrolnu grupu činili su uzorci koji nisu tretirani dezinficijensom. Uzastopna merenja istovetnih otisaka vršena su pomoću fotoaparata Canon G9 (12 megapiksela, 2 fps, 6 × / 24 ×), a automatizovana sa računara Asus VX 2R Lamborghini-Intel C2D 2,4 GHz, korišćenjem opcija softverskog paketa *Remote Capture* tako da su dobijene vremenske serije fotografija istog otiska. **Rezultati.** Utvrđene su izražene dimenzionalne promene svih uzoraka kako u funkciji vremena tako i u funkciji primenjenog dezinficijensa. Rezultati pokazuju postojanje značajnih razlika dimenzionalnih promena između grupe kondenzacionih silikona i grupe adicionih silikona za isto vreme i isti primenjeni dezinficijens ($p = 0{,}026$, $F = 3{,}95$). **Zaključak.** Najveće dimenzionalne promene otisaka uzetih adicionim i kondenzacionim silikonima beleže se u prvom satu po odvajanju sa modela.

Ključne reči:
stomatološki materijali za otiske; silikoni; dezinfekcija; zubna proteza.

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Introduction

Impression materials are used in dentistry to reproduce the form and relations of the teeth and surrounding oral tissues. Impressions are used for fabricating diagnostic and master casts. Silicone impression materials are widely used thanks to their excellent physical properties, favorable handling properties and good patient acceptance. Dimensional stability and accuracy of impressions under various conditions are crucial for the accuracy of the final prosthetic restoration. Accuracy of impressions also depends on the correct choice of impression material [1, 2].

In order to prevent transmission of infectious diseases such are hepatitis B virus (HBV) infection, AIDS, herpes infection and tuberculosis, disinfection of the entire dental equipment, including dental impressions, is mandatory. Dental impressions, contaminated with the patient's blood and saliva are a potential route of transmission of infection. Unfortunately, disinfection of dental impressions was not a routine procedure until the outbreak of AIDS in the late 20th century. Although the number of microorganisms decreases after rinsing impressions under water, a measurable bacterial load remains on the impressions and can be transferred to the casts [3]. Even though various disinfection treatments are being proposed, chemical disinfection of impressions by immersion in disinfectants is the most reliable and practical method. Immersion will disinfect both internal and external surfaces of an impression, including a tray and will minimize the risk of inhalation of disinfectant [4–6].

Two main concerns for disinfectant evaluation are: the efficiency of disinfecting solutions in eliminating pathogens, and the influence of disinfection treatment on the dimensional stability of dental impression materials.

The guidelines for the proper disinfection protocols in dental offices and laboratories are continuously issued by American Dental Association (ADA), Centers for Disease Control and Prevention, textbooks on dental materials, scientists, manufacturers of impression materials and others [7, 8].

A considerable number of articles has reported on dimensional stability of disinfected impressions [2–6]. Glutaraldehyde, used to be a commonly used disinfectant but iodophors, chlorine, alcohol and phenolic compounds were also tested. The most frequently used were elastomeric impression materials. Specimens were disinfected by spraying or immersing in disinfectant solution for the period to 60 min or longer. Control specimens were left in water, air or poured immediately. In estimating dimensional changes of impressions, measurements were taken either on the impressions or on the casts poured from those impressions. Because of the numerous variables and the above differences, direct comparison of the results of numerous researchers is difficult. The recommended exposure time for the most surface disinfectants is 10–15 min. However, repeated disinfection of an already disinfected impression is often done in a dental laboratory. The results of a research conducted by the ADA and British Dental Association (BDA) showed no good communication between dental offices and laboratories in terms of weather and which disinfection procedure was carried out [9]. The research of Giammanco et al. [10] shows that impressions must be disinfected immediately because the efficiency of certain disinfectants is reduced if disinfection is delayed for 6 h from the time of impression taking. Lepe and Johnson [11] state a significant effect of 2% glutaraldehyde on dimensional stability of A-silicones and polyethers if they are exposed to disinfectant for long (18 h). They advise disinfection of impressions in the recommended period of time that is necessary for disinfection of elastomers.

Since dimensional stability and accuracy of impression materials after removal from the mouth and disinfection are important factors in obtaining an accurate final restoration, the aim of this study was to assess the deformation of elastomeric materials after disinfection in antimicrobial solutions.

In this study it was assumed that impression disinfectants significantly affect the dimensional stability of these impressions.

Methods

This research was carried out *in vitro* in the Laboratory for Condensed Matter Physics, Faculty of Physics, University of Belgrade and in the Dental Laboratory, Clinic of Prosthodontics, Faculty of Dental Medicine, University of Belgrade.

For the purpose of this study individual custom resin trays [12] were designed (L-Palavit acrylic resin, Galenika, Serbia) for making impressions of teeth preparations on the model of epoxy resin. A model was obtained by duplicating the Kavo (Germany) master model of the upper arch representing three full metal-ceramic crown preparations (central incisor, first premolar and first molar). The tray was lined by an uniform thickness of wax spacer in order to mantain the uniform thickness of impression material. For adequate retention of the impression material the appropriate adhesive was applied to the tray (universal tray adhesive for impression silicones – Zhermack, Italy; universal adhesive for silicone impression materials – Heraeus Kulzer, Germany) according to the manufacturer's directions and allowed to air dry for 15 min in order to achieve maximum bond strength. A total of 120 impressions were obtained from the model of epoxy resin (40 impressions per each parameter, 10 impressions per each impression material). Four impression materials were used: two C-silicones (Oranwash L – Zhermack + Indurent-gel catalyst for C-silicone – Zhermack and Xantopren L Blue – Heraeus Kulzer + Activator universal – Heraeus Kulzer) and two A-silicones (Elite H-D + regular body – Zhermack and Flexitime correct flow – Heraeus Kulzer). All impression materials were mixed and used according to the manufacturer's instructions. The whole equipment and materials used in this study were kept at room temperature (23 ± 2˚C) and relative humidity of 50 ± 10% before being used [13].

The effect of each disinfectant (glutaraldehyde, benzalkonium chloride – Sterigum and 5.25% NaOCl) was examined on 40 samples made of these impression materials. The control group included 40 samples not treated with disinfectant solution.

According to the ISO 4823 [13] recommendations, the models were pre-heated in a water bath at 35 ± 1ºC.

The appropriate impression material was mixed and manipulated according to the manufacturer's instructions at room temperature, 23 ± 2ºC, and with a custom tray placed on a master model within the working time recommended by the manufacturer. The finger pressure was done over the tray until the stopers reached the teeth on the model. The model with the tray and impression material was placed in a special container and transfered to the water bath to maintain the temperature of 35 ± 1ºC, simulating open oral cavity temperature [14]. After 10 min from starting to mix, the tray with impression material was moved from the model.

The disinfectants used according to the manufacturer's directions, were: 5.25% NaOCl and disinfectant and detergent on the base of glutaraldehyde and benzalkonium chloride (Sterigum – Zhermack, Italy) that is virocidal [human immunodeficiency virus (HIV), HBV, hepatitis C virus (HCV)], bactericidal, fungicidal and tuberculocidal. Sterigum contains disinfectant glutaraldehyde 0.50 g / benzalkonium chloride 0.50 g in 100 g, and solvent (purified water to 100 g).

After removal from the model the impressions were immediately immersed in a container with the appropriate disinfectant for 10 min. Following disinfection, impressions were removed from the container, thoroughly rinsed under running water and air dried.

The whole measurement procedure was performed with a Canon G9 (12 megapixels, 2 fps, 6x/24x), and automated with a computer Asus Lamborghini VX-2R Intel C2D 2.4 GHz, by using software package Remote Capture. With the usage of the adapter – tube (Canon) and close up lenses (up to 10D, Hama), applied to the Canon G9 camera, highly reproducible macro photographies of the surface of impression material were obtained (Figure 1).

In our study the exact position of the camera to the sample was secured in two ways – experimentally and by using software. Experimentally, the camera was positioned by using laboratory cathetometers, which are commonly used in physical measurements. This means that at any time, the distance and orientation of the camera and the sample were determined with the limit of estimated error of 0.1 mm. The distance from the camera to the sample, in the macro mode, was more than 100 mm by using close-up lens, and therefore the relative error of distance was 0.1%. Additionally, camera was used in the manual focus mode, by using fixed focal lengths. Canon allows setting the focal length of lens at several fixed values, whose reproducibility are extremely accurate. In our software, the image analysis was performed after geometric transformation of recorded samples which is in accordance with predefined movements of the marked positions. This transformation is also used in geodesy for obtained photos processing in post-production of aero-photo images into ortho-photo.

Fig. 1 – Measurement – taking photos after impressions disinfection.

Identical impressions consecutive measurements were realized, and time-depending series of images of the same impression were initially received. Measurements serials were divided in subgroups of 60 shots in 30 min and were repeated several times during the day, after 24 h and after 7 days at the temperature of 23ºC. Measurements were realized within 10 min of the disinfectant treatment, within 30 min after removal of the impressions from the disinfectant, and later within 30 min after 1h, 24 h and 7 days.

The measures of dissimilarities of identical images in comparison to their modified forms with statistically distributed single pixel noise were obtained by the initial calibration procedure. This procedure allowed determination of the mean values of dissimilarities which were taken as a nominal shift in producing a pixel in a given series of images (Figure 2).

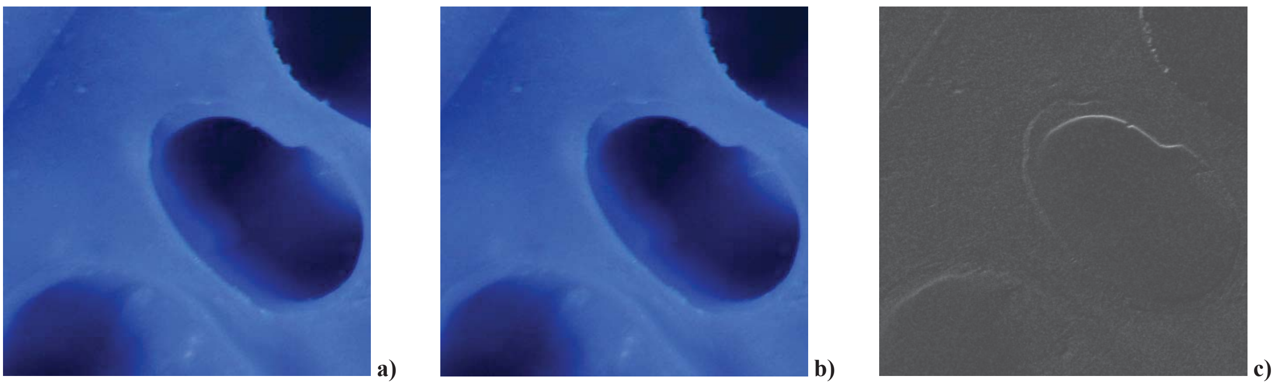

Fig. 2 – The same cut of the two photographies of an elastomeric impression: a) immediately after the removal, b) 30 min after the removal, and c) the differences.

The methods based on spectral Fourier analysis and approximations in the form of efficient fast fourier transform (FFT) solutions enable obtaining of the spectra of vectors and matrices of red, green and blue (RGB) values for each pixel, which are assigned values in each field. The identical numerical procedure determines the measure of dissimilarities of images whether in the native form or its FFT spectrum [15–19] (Figure 3).

The dimensional changes of the control samples, which were not exposed to disinfection treatment, were measured in function of time at the temperature of 23 ºC. Their mean accumulated values of dimensional changes were 0.178% after 30 min, 0.198% after 1 h, 0.440% after 1 day and 0.548% after 7 days.

In the first 30 minutes of measurements the mean accumulated value of dimensional changes for all samples after disinfection in 5.25% NaOCl was 0.220%, and for those disinfected in Sterigum 0.140%.

a) b) c)

Fig. 3 – Fast Fourier transform power spectra of identical cut of the two photographies of an elastomeric impression: a) immediately after the removal, b) 30 min after the removal, and c) the differences.

For the purpose of calibration study we developed software for calibration of measurements by using dissimilarity analysis.

Comparison of variables was performed by the Student's *t*-test and analysis of variance by ANOVA test.

A statistically significant difference between the groups or correlations of values of different parameters was accepted in accordance with the significance level criteria, $p < 0.1$.

Results

Table 1 shows the accumulated values of dimensional changes for the control samples and for the samples after disinfection in 5.25% NaOCl and Sterigum by the time of sample evolution in the first: 30 min, 1 h, 24 h, and 7 days.

Within 1 hour mean accumulated value of dimensional changes of the impressions after disinfection in 5.25% NaOCl was 0.613% and for those disinfected in Sterigum 0.373%.

After 1 day evolution of all the samples treated with 5.25% NaOCl was 1.053%, and after disinfection in Sterigum 0.598%.

After 7 days the mean accumulated value of dimensional changes of the samples treated with 5.25% NaOCl was 1.505%, and for the impressions disinfected in Sterigum 0.988%.

The dimensional changes of all the samples were significant both as the function of time and the applied disinfectant (Figure 4).

Table 1

Relative dimensional changes of the tested materials as the function of the applied disinfectant and the time from the moment of impressions removal

Material	Relative dimensional changes of elastomers – silicones (%) – estimated error limits = 0.025%											
	30 min			1 h			24 h			7 days		
	Control	NaOCl	Sterigum	Control	NaOCl	Sterigum	Control	NaOCl	Sterigum	Control	NaOCl	Sterigum
1 CS	0.19	0.23	0.14	0.21	0.65	0.44	0.49	1.22	0.65	0.58	1.89	1.11
2 CS	0.19	0.28	0.20	0.20	0.70	0.42	0.47	1.18	0.67	0.58	1.70	1.21
3 AS	0.16	0.20	0.12	0.19	0.55	0.33	0.40	0.93	0.58	0.52	1.20	0.85
4 AS	0.17	0.17	0.10	0.19	0.55	0.30	0.40	0.88	0.49	0.51	1.23	0.78
Statistics												
$\bar{x}$	0.178	0.220	0.140	0.198	0.613	0.373	0.440	1.053	0.598	0.548	1.505	0.988
p	0.073	0.068	0.065	0.066	0.070	0.067	0.060	0.047	0.083	0.043	0.040	0.040
Test value (F)	2.38	2.42	2.55	2.45	2.41	2.42	2.72	2.85	2.25	2.95	3.07	3.12

NaOCl – 5.25% sodium hypochlorite; Sterigum – disinfectant glutaraldehyde and benzalkonium chloride (Zhermack); 1CS – condensation silicone Oranwash L (Zhermack); 2CS – condensation silicone Xantopren L Blue (Heraeus Kulzer); 3AS – addition silicone Elite H-D+ regular body (Zhermack); 4AS – addition silicone Flexitime correct flow (Heraeus Kulzer); $\bar{x}$ – the average values of the obtained mean values of samples dimensional changes.

***p* – the level of significance of the applied test hypotheses compared to the grouped samples for the same applied disinfectant and the same time; test value – F-value one way ANOVA.**

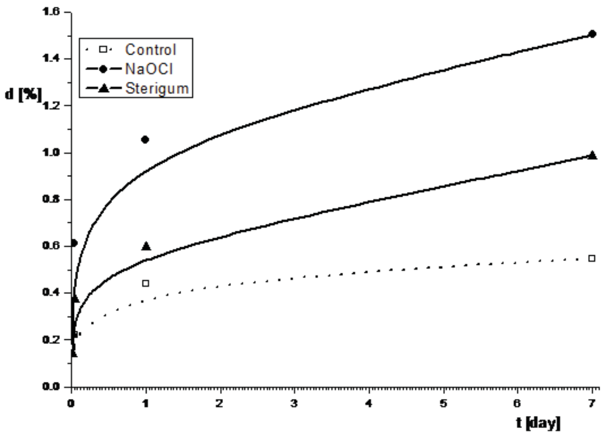

Fig. 4 – Average relative dimensional changes of all the samples as a function of time and the applied disinfectant.

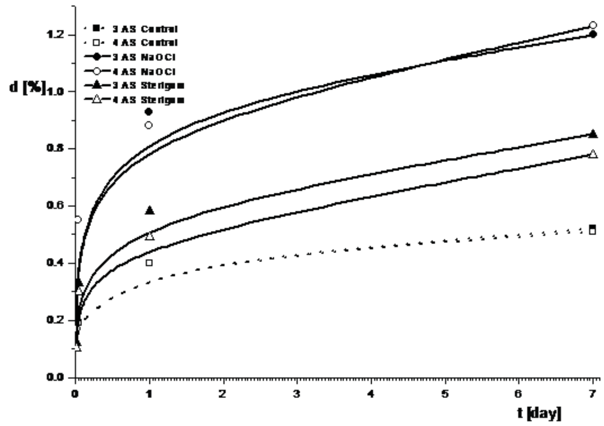

Fig. 6 – Average relative dimensional changes of addition silicones as a function of time and the applied disinfectant.

Statistical parameters which complement the above statement (Figure 4) are based on hypotheses about the presence of significant differences in the grouped results of the obtained dimensional changes of the tested impression materials without disinfecting treatment (control) as the function of time (p = 0.021, F = 42.1), then of the tested impression materials disinfected in 5.25% NaOCl as the function of time (p = 0.036, F = 393.2) and of those after the treatment in Sterigum as the function of time (p = 0.090, F = 35.1).

The values of statistical significances and associated F-values depending on the applied disinfectant for the same disinfecting treatment time intervals for different samples were p = 0.072, F = 2.44, (Figure 4).

Figures 5 and 6 show the differences in dimensional changes of condensation silicones compared to the addition silicones for the same time and the same applied disinfectant.

Statistical parameters that complement the above statement are based on the test of hypotheses about the existence of significant differences of the obtained dimensional changes between the group of condensation silicones and the group of addition silicones for the same time, and the same applied disinfectant (p = 0.026, F = 3.95) (Figures 5 and 6).

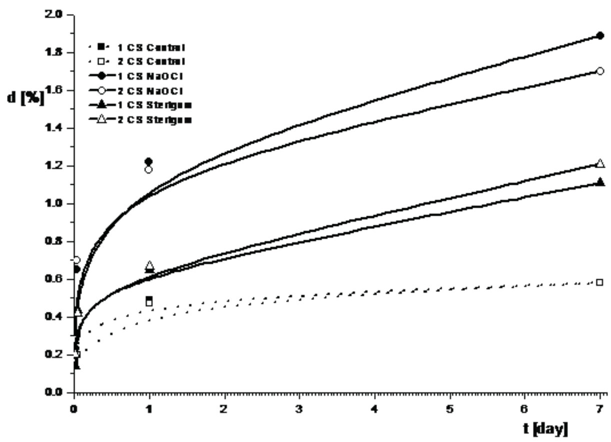

Fig. 5 – Average relative dimensional changes of condensation silicones as a function of time and the applied disinfectant.

Discussion

In numerous studies on impression materials tested for their dimensional stability depending on various factors, many different methods were used. In a certain number of studies dimensional stability of elastomeric impression materials was tested according to ISO 4823 (which corresponds to ADA Spec. No 19) and consisted of measuring the profiled grooves on elastomeric impressions made of the machined cylindrical mold, using a measuring microscope with the accuracy of 0.005 mm [13, 20].

The accuracy of that method dependes on the skill of the operator who carries out such measurements and on a translation screw of the microscope. Another drawback is that the tested elastomeric samples do not represent clinically relevant form. This means that in impression making and their removal, deformations of elastomers are not the same as in real impressions in clinical practice. A third limitation is that the prescribed measurements were recorded on a flat surface, disregarding the possibility of dimensional changes in three dimensions. Some studies have used this method [4, 21, 22], while the other authors [23–25] have introduced different modifications.

Modified techniques did not offer any significant advantages as they require fabrication of a test block out of an impression, introducing errors related to dimensional changes that could occur in the cast and measurements still depend on the microscope and micrometer.

Stober et al. [5] made impressions on the modified typodont master model containing simulated stainless steel crown preparations and measured the distance between the referent points on the master model and the gypsum cast obtained from elastomeric impressions of a master model after they had been disinfected. Dimensional changes of these materials were expressed in three dimensions. Their technique also required fabrication of a gypsum die from an impression and measurements were performed using a microscope.

Thouati et al. [26], for example, used a test block specimens as described in Normes Françaises specification which is in compliance with ADA Spec. No. 19 and ISO 4823.

Each test specimen was immersed in a disinfectant solution, rinsed in running water and the die stone was casted. The measurements of the referent lines were carried out on impression plaster reproduction in order to assess the dimensional stability of elastomeric impression materials.

In a 1983, Clancy et al. [27] examined the dimensional stability of three elastomers as the function of time using specimens from the stainless steel test block and a mold recommended by ADA spec. No.19 (ISO 4823). Impressions were placed under the reflecting microscope and the images were projected on the screen of the image analyzing computer. Measurements were performed on the referent lines on the specimens.

In one of the referent studies specimens were measured using the two methods, one using micrometers, and the other using a scanning laser digitizer with an automatic data processing in order to evaluate the dimensional stability and accuracy of impression materials. Measurements were performed on the casts made from the impressions. The study found that more precise measurements were achieved by using a scanning laser [28].

DeLong et al. [29] in 2001 examined the factors influencing optical 3D scanning of polyvinyl siloxane impression materials. They pointed the importance of the surface angle of digitizing and surface texture of these materials.

The inability to scan impressions due to the difference in reflectivity of these impression materials has led to the need to use the replication technique, stone casting. Assessment of dimensional stability was based on the analysis of the images of the scanned stone casts. Except for these disadvantages that have to be overcome by the appropriate adjustments to the scanner, it should be noted that this method is very expensive [30].

In the present study an epoxy resin master model was used that resembled the upper arch containing three teeth preparations for complete metal-ceramic crowns. Measurements were performed directly on the elastomeric impressions, without the need to use the replication technique (stone casting).

According to the authors' knowledge, none of the studies has used this method for analysis of digital images of elastomeric impressions of the complete dental arch in order to evaluate the dimensional stability of impression materials, depending on various factors. The method was developped at the Faculty of Physics, University of Belgrade, as a fully original method for investigation the evolution of polimers. Up to this study, this method has not been used in the field of dentistry.

The advantages of the methods applied in the present study compared to other methods described in a number of references, are based on the use of the originally two-dimensional analysis of changes in the whole visual field and on the three-dimensional analysis that was obtained by fine analysis of colors and tones in the shadow areas.

Another advantage comes from measuring at numerous points. The accuracy of the obtained values of dimensional changes was increased due to high reproducibility and mutual comparison of all images.

The disadvantage of the methods applied in this study was that it could not be clearly detected whether contraction or expansion of the tested materials occured, although detection of dimensional changes was precise.

Another problem is that in terms of surface reactions or in the conditions in which the specimen changes color during maturation, this method shows slightly higher values of dimensional changes than those stated by other authors [21, 31]. However, even with such lacks of the used methods, the results are in accordance with the ISO standardization.

There are many factors that affect the dimensional stability of elastomeric impression materials. Among them are contraction during polymerization as a result of volume reduction due to the cross linking and alcohol evaporation, which is typical for C-silicones. Another factor that may change the dimensional stability of elastomers is expansion that may occure after immersion in disinfectant solutions. The incomplete elastic recovery of these materials may also lead to dimensional changes.

Elastomeric impression materials dimensional changes after immersion in various disinfecting solutions are complex and relate to their individual chemical composition. Although the major ingredients of each material are known, the specific amount of these components is the secret of each manufacturer. Certain ingredients, may be present in ample quantity or may be absent. Therefore, the behavior of a certain material is difficult to relate to its chemical composition [23].

Some publications on the effect of disinfectants on the dimensional stability of elastomers state that the disinfecting process does not have an adverse effect on the dimensional stability of impressions [24, 32–35]. Others, however, point to the negative effect of disinfecting agents on elastomers [6, 26, 35].

Dimensional changes of impression materials occur in three dimensions. The methods depending on measuring microscope are one dimensional and neglect dimensional changes that exist in all three dimensions [21, 26, 27]. The studies of Saleh Saber et al. [23] and Kronström et al. [24] illustrate the reference points and distances for measurements of three-dimensional objects which confirm the existence of three-dimensional changes, that is in accordance with the results of the present study.

The results of Jagger et al. [36] demonstrate that even though the dimensional changes of addition silicones after disinfection are small, in the order of microns, they may be of clinical significance for further procedures.

Evaluating the influence of immersion period in disinfectant solutions on dimensional change of elastomers, Carvalhal et al. [22] note that there are time limits within disinfection which must be performed, because of the reactivity of disinfecting agents. They also emphasize that in shorter immersion periods, sodium hypochlorite solution lead to greater dimensional change of condensation silicone (Xantopren) compared with glutaraldehyde, which is in accordance with the results of the present study.

Thouati et al. [26], in assessing the dimensional stability of addition and condensation silicones after disinfection in

5.25% NaOCl for 30 min, point out the changes up to 0.46%, which corresponds to the values obtained in this study for the same disinfectant. This disinfectant has affordable price, but is unstable over time and has to be made fresh daily to ensure the necessary efficiency. The authors underline that chlorine is a highly reactive element and in the concentration of 5.25% could react and fix on the impression material. When condensation silicones are used, these authors suggest that impressions should be poured as soon as possible. This is in agreement with the results of Saleh Saber et al. [23].

The beginning of disinfecting treatment strongly affects the stability of impression materials and critical changes occur in the first few minutes. In fact, the half of all the changes occures in the first 4 min. These results agree with the results of Melilli et al. [21]. Their findings suggest that immediate disinfection by immersion always induces a significant expansion of the impression material, while the second disinfection, repeated 6 h after the first one, does not cause any significant dimensional change, probably due to chemical stabilization of the material that occurs in the first hours after the impression taking.

The mean value of accumulated dimensional changes obtained in this study for A-silicones after disinfection in glutaraldehyde is in accordance with the results of Wadhwani et al. [37] and amounted to 0.10–0.12% for a 30-minute period, and after one hour the change was 0.30–0.33%.

In the present research, the values obtained within 30 min of disinfection of addition silicones in glutaraldehyde (0.12%) correspond to the results of Melilli et al. [21]. They show that immediately after immersion of addition silicone specimens in glutaraldehyde for 5 min, dimensional changes of A-silicones are significant (0.13%), compared to the initial measurement prior to disinfection.

For glutaraldehyde (Sterigum) the change, accumulated after a day for all the specimens in the present study was 0.598%. Therefore, pouring casts from impressions may be postponed for a day.

Generally, A-silicones in the current study were more stable than C-silicones. However, the two tested materials Xantopren L Blue (Heraeus Kulzer C-silicone) and Flexitime correct Flow (Heraeus Kulzer A-silicone) showed better stability than the other two tested materials.

Some of chemical immersion disinfectants in higher concentrations could cause the adverse surface changes of an impression material [38]. This should not be neglected in evaluation impression material dimensional stability. The photometric method is so precise to detect the discoloration caused by that minor surface changes, as well as the significant dimensional changes of the impression material.

Conclusion

According to the results of this research we can conclude that, generally, A-silicones are more stable than the C-silicones for the same time and the same applied disinfectant. The greatest dimensional changes of both addition and condensation silicone impressions are reported in the first hour after their separation from the model. The beginning of activity of disinfectants strongly influences the stability of these impression materials and critical changes occur in the first few minutes. Disinfection of addition and condensation silicone impressions with 5.25% NaOCl leads to great dimensional changes. In the mandatory disinfection of the addition and condensation silicone impressions the usage of NaOCl of the concentration of 5.25% should be avoided. Condensation silicones exposed to 5.25% NaOCl after the second day show dimensional changes more than 1%. Addition silicones are stable, with the dimensional changes less than 1%. The use of disinfectants that contain benzalkonium chloride and glutaraldehyde (Sterigum) does not significantly change dimensional stability of the tested elastomeric materials.

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