The Assessment of the Surface Status Following the Action of Some Acidic Beverages on Indirect Restorative Materials

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The study aimed to assess the changes of the surface roughness induced by some acidic beverages on indirect restorative materials by using profilometry. Twenty samples of three composite resins (Ceramage, SR Adoro, Luna-Wing) and three ceramics (IPS In Line, Hera Ceram, Reflex Dimension) immersed in three acidic beverages (Red Bul, wine, Coca Cola), for 5 minutes, three times daily, 14 days. The control samples were immersed in artificial saliva during the study periode. After the end of the erosive cycles and before to determine the surface roughness of the samples in the study groups, all the samples were immersed in artificial saliva for 18 hours. The surface roughness was determined in relation to the baseline surface using profilometer Perthometer_M1 (Mahr Gottingen GmbH, Germany). The immersion of the indirect restorative materials tested in the three acidic beverages lead has resulted to changes in their surface roughness. The most aggressive was wine, followed by Coca Cola, and Red Bull.

Keywords: acid beverages, erosion, ceramic, composite resins

The noncariogenic loss of the dental hard tissues represent an issue that generate much interest in the actual dental practice. The multitude of variables that define the onset, clinical aspects, evolution and prognostic of these lesions represents a challenge both for researchers and dentists and make difficult the choice of an adequate therapeutic approach with long term optimal results.

In most cases the noncariogenic dental lesions appear by the combination of abrasion, attrition and erosions. Their ethiology is complex due to the implication of numerous intrinsec and/or extrinsec factors [1-6].

The resistance to acidic deterioration of the dental hard tissues in a complex oral environment [1-11], influenced by the individual particularities and nutritional habits [12-17] represent parameters that must be taken into account regarding the selection of the indirect restorative materials for the treatment of the noncariogenic dental lesions.

Regarding the modern preventive-therapeutical management of these lesions, the practitioner must rely on minimal invasive means and techniques that will offer both long term therapeutical results and the diminishing of the healthy dental tissues sacrifice [7, 8, 18, 19].

The knowledge of the clinical and ethiological particular aspects of the noncariogenic cervical dental lesions can improve the prognostic by an adequate selection of the clinical cases and treatment protocoles [20].

Some authors propose the treatment of the erosive dental lesions by direct composite resins and modern adhesive systems, with or without the association of a glassionomer cement [21-27]. Some stages of the working protocol for the treatment with direct restorative materials (isolation, adhesion, insertion technique, finishing, polishing) represent a challenge regarding the long term esthetic and functional results [28, 29].

In the clinical situations with extended loss of hard dental tissues by erosions that affect numerous dental surfaces it is required a therapeutic approach by indirect restorative materials, using ceramics or indirect composite resins. The indirect therapeutic approach is performed by using veneers, inlays, onlays, and crowns.

The indirect restorative methods using composite resins and ceramic mass supplies long term optimal results [30-32]. These materials have biological and aesthetic properties and are considered (by most producers) as chemically inert. However numerous factors can influence their longevity (composition, microstructure, chemical properties, erosive ability of acid agents, exposure time, temperature) [33-36].

The solubility of a material represents its capacity to dissolve in a fluid environment (water, saliva). The erosion of a material is a complex process represented by dissolution associated with a mild mechanical action.

A material can be stable at neutral *p*H but can be affected by erosion processes at extreme *p*H (acid or alkaline). This can explain the different behavior of the same material and the quantitative and qualitative changes related to the oral environment and nutritional habits of the patient [35]. These elements must be taken in consideration by dentists when is confronted with a choice for the adequate approach of the dental erosions treatment [37-42].

Various methods can be used to test resistance of the restorative materials to acid attacks. The profilometry can be used with good results on surfaces affected by erosive processes of minimum 0.4ìm. Also the profilometry can be applied in indirect measurements of the intraoral erosions by using replicas.

The literature data [43-49] show relevant conclusions regarding the behavior of some acidic foods and beverages with erosive action. Less clear are data regarding the changes induced by these products on direct and indirect restorative materials.

The aim of this study was to assess the changes of the surface roughness induced by some acidic beverages on indirect restorative materials by using profilometry.

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Table 1
THE EXAMINED MATERIALS

Material	Material type	Material composition	Trade name	Manufacturier
composite	Composit emicro ceramic	Zirconium silicate micro ceramic a PFS (Progressive Fine Structure) filling of more than 73% organic polymer matrix	Ceramage	Shofu Dental Corp. Kyoto, Japan.
	Microfilled, light-/heat-curing veneering composite	Prepolymerbased on nanofillers and the new UDMA Urethane dimethacrylate (UDMA) (17–19 wt.%); copolymer and silicon dioxide (82–83 wt.%), stabilizers, catalysts and pigments (<1wt.%). The total content of inorganic fillers is 64–65 wt.%/46–47 vol.%. Particle size 10-100 nm	SR Adoro	Ivoclar Vivadent,
	Nanocomposite	Indirect nanocomposite resin, one of the highest-density filler products using a mix of different-sized inorganic fillers metacrylate monomer, organic fillers, inorganic fillers, pigments, silane coupling agent	Luna-Wing	Yamamoto Precious Metal Co, Ltd Tokyo.
ceramic	Leucite-containing veneering ceramic	SiO2:40-65%, A12O3,B2O3, BaO, CaO, CeO2, K2O, MgO, P2O5, TiO2, ZrO2	IPS In Line	Ivoclar Vivadent, Schaan,Liechtenstein
	Microfineleucite-containing veneering ceramic	ZrO2+ HfO2+ Y2O3> 99 % Stabilised leucite structure (SLS) microfine leucite crystals	Hera Ceram	Heraeus-Kulzer GmbH, Germany
	Nanoleucite-containing veneering ceramic	Aluminosilicate glass-based systems SiO_2: 40-65% Fillers: nano-leucite	Reflex Dimension	Wieland Dental Tehnik GmbH & Co, Pforzheim, Germany

Experimental part

The study assessed the erosive potential of three commercial beverages: Red Bull (S.C. Red Bull Romania S.R.L.), Coca Cola (Coca Cola HBC Romania SRL), wine Cotnari Francusa (S.C. Compania S.A., Iasi Romania) on restorative indirect materials: three composite resins (Ceramage, SR Adoro, Luna-Wing) and three ceramics (IPS In Line, Hera Ceram, Reflex Dimension). The type of restorative materials and their composition are presented in table 1.

The assessment of beverages pH was performed using pH-meter Checker (HANNA Instruments Romania), by immersion of the tips in 30 mL liquid. Final result can be read on display. *p*H values of the examined beverages are presented in table 2.

Twenty samples (10 mm diameter, 2 mm thickness) were manufactured from each examined material. The samples preparation was performed respecting the producers indications related to the thermic preparation regime during setting reaction. The samples were submitted to the same polishing procedures, using silicone carbide sandpaper (3M ESPE, St.Paul, MN, USA) placed in a device (Phoenix 4000, Buehler GmbH, Düsseldorf, Germany), under water cooling. All samples were cleaned in distilled water for 10 min using ultrasonic device, and dried using air spray. The surfaces features were examined using optic stereomicroscope SMZ 1500 m (Nikon Instech, Kanagawa, Japan), under 40X magnification, to highlight the defects as pores and fissures. None of the samples was associated with defects to require the exclusion from study. The samples of each material were randomly divided in four groups. In the three study groups the samples were immersed in wine (study group I), Red Bull (study group II), Coca Cola (study group III) following the same protocol: immersion for 5 min, 3 times daily, for 14 days. During immersion in acidic beverages, the same volume of beverage was used (30 mL) for each sample. Between the erosive cycles the samples were immersed in artificial saliva Fusayama- Mayer (30 mL/sample). In the control group (group IV) the samples were immersed in artificial saliva. The composition of the artificial saliva is presented in table 3.

After the end of the erosive cycles and before to determine the surface roughness of the study groups samples, all the samples were immersed in artificial saliva for 18 h. The samples were submitted to the profilometric analysis. The surface roughness was determined in relation to the baseline surface using profilometer Perthometer M1

Table 2
THE *p*H VALUES OF THE EXAMINED BEVERAGES

Drink category	Commercial brand	pH	
Sport drink Acid beverage White wine	Red Bull Coca Cola Cotnari Francuşa	3.35 2.44 2.20	

Table 3
ARTIFICIAL SALIVA COMPOSITION

Saliva Fusayama- Mayer	
Composition	g/L
NaCl	0.4
KCl	0.4
$CaCl\cdot 2H_2O$	0.795
$NaH_2PO_4\cdot 2H_2O$	0.690
$Na_2S\cdot 9H_2O$	0.005
Uree	1.00

(Mahr Gttingen GmbH, Germany). The traceability parameters have been established to Lt: 1.5 mm and Lc: 0.25 mm, at a 0.4 μm profilometric accuracy . Ten readings for each sample were performed and mean wear volume was calculated. The recorded roughness data were as follows: Ra, Rz, Rmax, Pc. The stylus moving distance was 4 mm. The measuring force was 4 mN, and the moving speed was 0.5 m/s.

Results and discussions

The *p*H of the examined acidic beverages varied between 2.20-3.35. The roughness values for both categories of indirect restorative materials are presented in the tables 4-9.

Following the results analysis, it was recorded the change of the roughness parameters for all study groups (ceramic mass, composite resins) after the immersion cycles in all the three examined acidic solutions.

Regarding the composite materials, Ceramage has the highest Ra value after the immersion in wine (0.5509), followed by Coca-Cola (0.521) and Red-Bull (0.512). The highest Rz value was recorded after immersion in wine (3.231), followed by Coca-Cola (3.009) and Red Bull (3.007).

For Adoro, the highest Ra value was recorded for immersion in wine (0.442), followed by Coca-Cola (0.406) and Red-Bull (0.398). The highest Rz value was recorded for immersion in wine (2.654), followed by Coca-Cola (2.611) and Red-Bull (2.545).

For Luna, the highest Ra value was obtained for immersion in wine (0.542), followed by immersion in Coca-Cola (0.532) and Red-Bull (0.502). The highest Rz value was recorded for immersion in wine (2.678), followed by Coca-Cola (2.546) and Red-Bull (2.345).

The results obtained for the examined resine composite materials showed that the most important changes were recorded for Ceramage, followed by Luna and Adoro.

The roughness changes were also recorded for ceramic materials.

For Reflex, the highest Ra value was obtained for immersion in wine (0.901), followed by Coca-Cola (0.834) and Red-Bull (0.813). The highest Rz value was recorded for immersion in wine (4.978), followed by Coca-Cola (4.832) and Red-Bull (4.745).

For Hera, the highest Ra value was recorded for immersion in wine (0.879), followed by Coca-Cola (0.852) and Red-Bull (0.833). The highest Rz value was recorded for immersion in wine (4.993), followed by Coca-Cola (4.963) and Red-Bull (4.765).

For Inline, the highest Ra value was recorded for immersion in wine (0.954), followed by Coca-Cola (0.918) and Red-Bull (0.887). The highest Rz value was recorded for immersion in wine (5.321), followed by Coca-Cola (5.243) and Red-Bull (5.012).

The results obtained for the examined ceramics showed that the most important changes were recorded for InLine, followed by Reflex and Hera.

Table 4

THE ASSESSMENT OF SURFACE ROUGHNESS (CERAMAGE)

composite Ceramage					Eroare standard					Eroare relativa		
	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec
Ra (mm)	0.4821	0.5123	0.5210	0.5509	0.0681	0.0904	0.1734	0.0472	14.14%	17.66%	33.29%	8.57%
Rz (mm)	2.7817	3.0075	3.0090	3.2310	0.4752	0.5459	0.7991	0.3526	17.09%	18.15%	26.56%	10.91%
R_{max} (mm)	4.036	4.1133	4.1481	3.425	0.6001	0.8030	1.8663	0.7277	14.87%	19.52%	44.99%	21.25%
Pc (/cm)	118.22	130	120.72	132.8	40.748	38.912	46.297	28.522	34.47%	29.93%	38.35%	21.48%

Table 5

THE ASSESSMENT OF SURFACE ROUGHNESS (ADORO)

composite Adoro					Eroare standard				Eroare relativa			
	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec
Ra (mm)	0.334	0.398	0.406	0.442	0.028	0.049	0.066	0.066	8.40%	12.55%	16.34%	15.00%
Rz (mm)	2.232	2.545	2.611	2.654	0.241	0.429	0.430	0.285	10.83%	16.88%	16.46%	10.74%
R_{max} (mm)	2.746	3.663	3.386	3.44	0.571	1.458	0.793	0.458	20.80%	39.83%	23.43%	13.32%
Pc (/cm)	98.4	115.2	112	122.9	16.88	26.82	31.26	42.37	17.16%	23.28%	27.91%	34.48%

Table 6

THE ASSESSMENT OF SURFACE ROUGHNESS (LUNA)

composite Luna					Eroare standard				Eroare relativa			
	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca -Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec
Ra (mm)	0.481	0.502	0.532	0.542	0.176	0.056	0.075	0.040	36.75%	11.21%	14.11%	7.53%
Rz (mm)	2.301	2.345	2.546	2.678	1.072	0.392	0.475	0.360	46.60%	16.74%	18.69%	13.46%
R_{max} (mm)	5.123	3.014	3.224	2.307	1.965	0.731	1.361	0.583	38.37%	24.28%	42.22%	25.28%
Pc (/cm)	124.6	112.8	92.44	57.45	21.96	34.45	20.82	30.10	17.62%	30.54%	22.53%	52.40%

Table 7
THE ASSESSMENT OF SURFACE ROUGHNESS (REFLEX)

ceramic Reflex					Eroare standard				Eroare relativa			
	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec
Ra (mm)	0.782	0.813	0.834	0.901	0.102	0.144	0.132	0.090	13.07%	17.77%	15.91%	10.06%
Rz (mm)	4.678	4.745	4.832	4.978	0.397	0.536	0.619	0.571	8.50%	11.30%	12.82%	11.47%
R_{max} (mm)	6.509	6.031	6.241	6.46	0.766	0.672	1.085	1.861	11.78%	11.15%	17.39%	28.81%
Pc (/cm)	166.4	183.3	164	154.1	20.23	21.42	15.44	38.38	12.16%	11.69%	9.42%	24.89%

Table 8
THE ASSESSMENT OF SURFACE ROUGHNESS (HERA CERAM)

ceramic Hera Ceram					Eroare standard				Eroare relativa			
	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec
Ra (mm)	0.776	0.833	0.852	0.879	0.146	0.107	0.065	0.112	18.84%	12.95%	7.68%	12.75%
Rz (mm)	4.657	4.765	4.963	4.993	0.723	0.610	0.456	0.662	15.53%	12.81%	9.20%	13.27%
R_{max} (mm)	6.815	6.388	5.661	6.550	1.206	0.936	1.001	1.460	17.71%	14.66%	17.69%	22.30%
Pc (/cm)	172.3	163.33	167.27	176	21.57	25.18	14.51	26.04	12.52%	15.42%	8.68%	14.80%

Table 9
THE ASSESSMENT OF SURFACE ROUGHNESS (IN LINE)

ceramic In Line					Eroare standard				Eroare relativa			
	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec	martor	Red-Bull	Coca-Cola	Vin sec
Ra (mm)	0.858	0.887	0.918	0.954	0.102	0.0893	0.111	0.111	11.94%	10.07%	12.15%	11.65%
Rz (mm)	5.012	5.113	5.243	5.321	0.616	0.5314	1.064	0.479	12.29%	10.39%	20.29%	9.01%
R_{max} (mm)	6.366	7.412	6.777	6.631	1.068	2.457	2.017	0.819	16.78%	33.15%	29.77%	12.36%
Pc (/cm)	174.1	156.6	168	174.5	19.90	46.20	15.54	28.58	11.43%	29.49%	9.26%	16.37%

The values Ra and Rz for all three composite resins and ceramics are presented in figures 1-8.

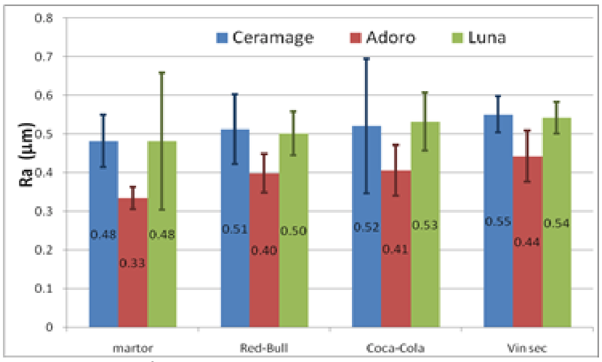

Fig. 1. Ra values for the three composite resins immersed in saliva (control) and acidic beverages (wine, Red Bul, Coca Cola)

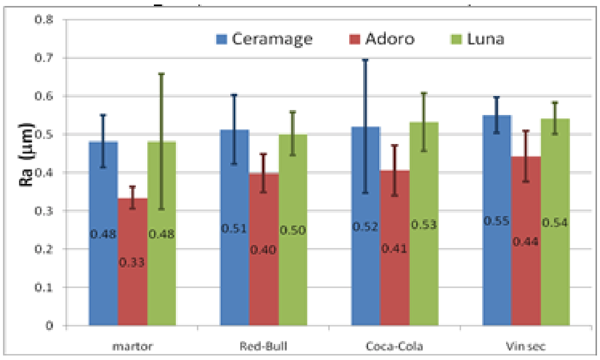

Fig. 2. Comparative variations of Ra values for the three composite resins

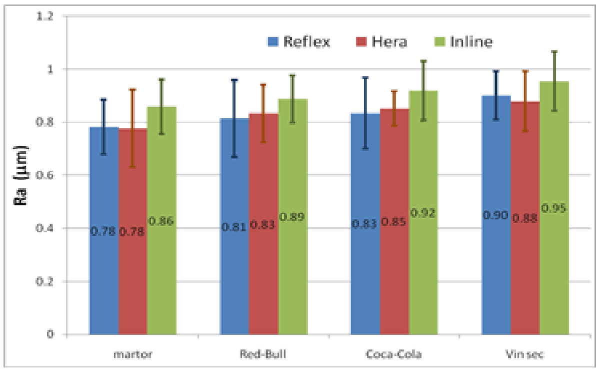

Fig. 3. Ra values for the the three ceramic mass imemersed in artificial saliva (control) and erosive beverages (wine, Red Bul, Coca Cola)

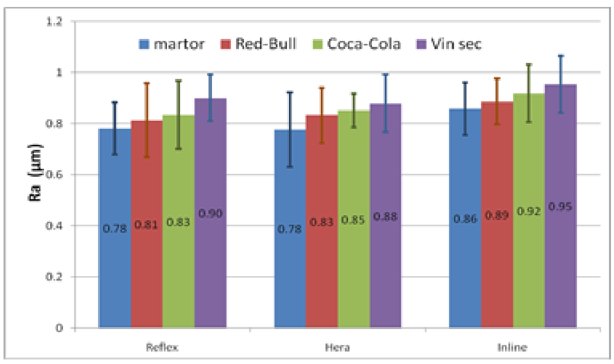

Fig. 4. Comparative variation of Ra values for the three ceramics

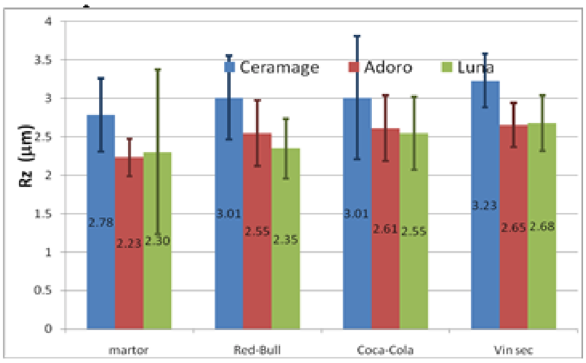

Fig. 5. Rz values for the three composite resins immersed in saliva (control) and erosive beverages (wine, Red Bul, Coca Cola)

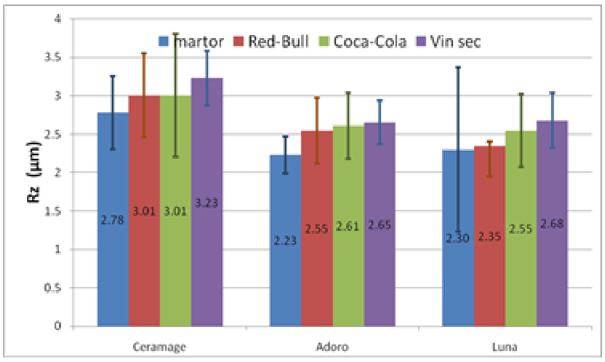

Fig. 6. Comparative variation of Rz values for the three composite resins

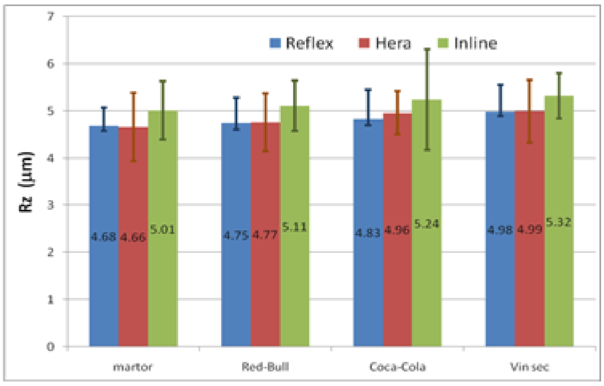

Fig. 7. Rz values for the three ceramics immersed in saliva (control) and erosive beverages (wine, Red Bul, Coca Cola)

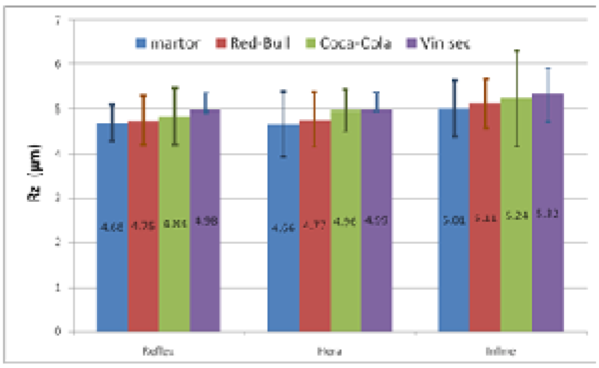

Fig. 8. Comparative variation of Rz values for the three ceramics

Comparing the examined groups of materials, we found the higher roughness changes for indirect composite resins and less visible roughness changes for ceramics.

Comparing with control, significant changes of roughness parameters were recorded for all study groups immersed in the erosive beverages, with highest changes recorded for wine immersion. The analysis of the results showed that the roughness changes are produced by a chemical attack associated with the attenuation of the surfaces roughness peaks.

One of the most known factor in the onset of the dental erosive wears is considered the frequent consume of the high *p*H beverages as sport drinks, cola drinks, the drinks with content of citric acid or phosphoric acid cola, and alcohol (especially dry wine) [44-46, 49, 50].

The abusive wine consumption as well as the professional exposure to wine (sommeliers) represent decisive factors in the onset of the erosive lesions for this people category [44, 51-53]. The most relevant alcoholic drinks associated with development of the dental erosions are as follows: white dry wine, red wine and champagne. Some wines have a low *p*H [47, 48, 53, 54]. White wines can have a *p*H between 2.3-3.3, and *p*H of red wines varies between 3.0-3.5 [51, 55, 56].

Nowadays, the researchers propose various methods and techniques for the analysis of the changes induced by the erosive attacks both on the hard dental tissues [55-58] and the direct and indirect restorative materials used for the therapy of the dental erosive lesions [59-61]. The most frequent used methods are as follows: profilometry, microscopic measurement techniques, microradiography, optical microscopy, SEM, microscopy**,** 3D confocal scanning microscopy, EDX spectroscopy, atomic force microscopy, microhardness tests, white light interferometry, optical coherence tomography (OCT) [62].

Considering the guide of the bioanalytical methods validation, the testing procedures must present a variation coefficient under 10% for the inter operator reproducibility and a variation coefficient under 20% for the inter operator reproducibility. It must be determined the inferior limits of quantification for each method that will be used, considering for the analysis only those values that overpass the detection limit + 5 SD. The detection limit and the method accuracy can depend by the analyzed material. These parameters cannot be acquired from the producer description. The qualitative assessments are influenced by the subjective classification and interpretation. However, the quantitative assessment must be preferred to obtain measurable and objectives data. The qualitative methods (SEM, CLSM) can be used to visualize the changes of the dental structure, providing an overview of the impact of the different factors on the substrate represented by the hard dental tissues [58].

The substance loss and the roughness of the hard dental surfaces submitted to erosive attacks can be determined by profilometry, scanning the samples with a laser beam or a stylus (metal, diamond) with diameter 2-20μm [62-65]. The contact stylus is loaded with a force of a few mN.

By scanning is generated a topographic map of the examined surface. The stylus tip can produce scratches to the eroded and non-eroded surfaces and atomic force microscopy can be used to measure the depth of these scratches (in nanometers). The use of laser allows to obtain a superior resolution in comparison with the use of stylus (10 nm). The use of laser can conduct to the apparition of artefacts [66]. The comparisons of scanned images at baseline and after the erosive attack as well as the determination of the depth differences can be performed using software [7, 67]. In this case is requested the reproducibility of the positioning in profilometer. The polished surfaces are used in the profilometry to detect the changes resulted by the erosive/wear processes. However, in the enamel affected by minimum 50μm erosion, these measurements can be performed on unpolished surfaces.

Chadwick et col. presented a method used to obtain digital models of surfaces, using electroconductive replicas generated by teeth silicon imprints [68]. The replicas were used to create maps (resolution 1μm) by using a controlled computer probe [69-72]. The generated map can be compared using an algorithm to detect the differences between the examined surfaces. The use of these techniques provides better accuracy and reproducibility [68, 71]. The erosive processes with a depth of minimum 50μm were measured with +/-15μm accuracy on a period of 9 months [68].

Despite the fact that indirect restorative materials (composites, ceramics) are considered inert by producers Cu toate cã materialele utilizate pentru refacerile indirecte (mase ceramice, compozite), their exposures to physico-chemical factors can influence the surface status, composition, microstructure and longevity [30-33, 73, 74].

Our study sustains the literature data that confirms the changes induced by the acidic drinks on surface status of the indirect restorative materials [30-33, 73-75].

The results obtained for the samples immersed in the erosive solutions reject the null hypothesis (these materials are inert). Mild changes of the roughness parameters are recorded even for the immersion in artificial saliva.

Two mechanisms can explain the processes influencing the changes recorded for the ceramic materials [30, 31]. The first mechanism is represented by the selective release of alkaline ions, the second mechanism is represented by the dissolution of the silicate ceramic network (Si-O-Si) [30, 31]. These mechanisms can be controlled by diffusion of hydrogen and (H_3O^+) ions from the aqueous solution in ceramic and by the release of alkaline ions from the ceramic surface into the aqueous solution to maintain *electric neutrality* [30, 31].

Ra value is the most used parameter for roughness in the researches focused on dentistry and other engineering domains. This value is limited by the bidimensional aspect, providing only informations related to roughness height, without addressing to the roughness profile [71]. In this study we also used parameters Rmax, Rz, Sm, as well as the analysis by optical stereomicroscope SMZ 1500m (Nikon Instech, Kanagawa, Japan) to improve the assessment accuracy Rmax and Rz represent the altitude parameters on vertical axe (depth of the eroded areas). Sm shows the mean space between peaks (width of the alteration areas).

The combination of the quantitative and qualitative data can conduct to the obtaining of the tridimensional qualitative values of the tested surfaces [76-78].

In the last decades the consumption of acidic beverages increased significantly, especially by the consumption of cola drinks [7, 10, 45, 46]. For patients with decreased saliva buffering ability and chronic consumption of the acidic beverages, at *p*H under 3, the erosive effect is significant [2, 7]. Wine, a frequent consumed drink, with a content of lactic acid, malic acid and tartaric acid, has an erosive effect due to *p*H between 3,3 and 3,8 [44, 47, 48]. The chronic alcohol consumers and the sommeliers are the most affected people, with a high risk of dental erosion [47, 54, 58]

The stability of the chemical and biological processes can be influenced by *p*H value. The researchers found that wines with high *p*H values contain increased levels of potassium and lower levels of acids, while the wines with lower *p*H values contain mostly tartaric acids and malic acids (mostly 2/3 tartaric acid, 1/3 malic acid) [44, 47, 48, 51-54]. During fermentative processes the wine pH decreases and malic acid converts in lactic acid and carbon dioxide.

Previous studies [30-33, 61, 73-82] concluded that the acid attacks in various conditions of intraoral pH, can conduct to the degradation of the restorative materials, determining a decrease of the resistance, with an increase of the roughness and the surface dissolution by erosion, associated to other structural changes as bacterial plaque accumulation, color change, material ageing (especially for composite materials) [79]. The researches confirm that these changes are related to the selective release of the alkaline ions from the material composition [73, 74].

As this study represents an in vitro research, to simulate intraoral conditions are requested further in vivo researches that will focus also on temperature variations, fluctuation dynamics of the intraoral *p*H, the presence of the acquired pellicle and other conditions to provide more accurate results.

The resistance of the indirect restorative materials to the acid attacks in the oral environment represents an important element to consider for the choice of the restorative material.

Conclusions

The exposure of the indirect restorative materials to various solutions with erosive potential determines surface roughness changes. The comparison of the erosive effect of various acidic beverages on indirect restorative materials demonstrated that the most important changes are produced by wine, followed by Coca-Cola and Red-Bull. It was not recorded the surface erosive change, under the action of the examined acidic beverages, for both groups of tested materials (ceramic mass, composite resins). This result motivates the use of the indirect restorative materials for patients with dental erosions associated with extended loss of the dental hard tissues.

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