Colour Stability of Acrylic Prefabricated Denture Teeth in Contact with Alimentary Staining Drinks

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The choice of denture artificial teeth is made up onto several criteria regarding both aesthetics and functionality. Of these, colour stability is one of the determining factors. Colour stability of materials used in aesthetic prosthetic restoration is important for the long-term success of the treatment. Our study was conducted to compare colour stability of different acrylic artificial teeth available on the market and usually used in manufacturing partial and full dentures in Romania and to find a ranking of staining ability of different solutions with which artificial teeth could come into contact lately, during function or cleaning phases. For this study were purchased six boxes of identical front superior acrylic denture teeth from four different manufacturers, coded by letters V, M, R and S). These teeth were immersed in various liquids such as red wine, Coca Cola, black tea, coffee, which we considered to be ingested frequently by the largest part of the population. Our study shows that, of the four analyzed drinks, the most colouring is coffee. The same operator determined the color coordinates using the Easy-Shade intraoral spectrophotometer. The results were expressed using CIELAB colour notation system. Color difference was expressed as ΔE. A device was made for constant positioning the tooth versus the Vita Easy Shade spectrophotometer rod used to determine colour changes in the central third of the buccal area. The acrylic prefabricated teeth suffered various colour changes in contact with those drinks, with magnitudes depending on the type of the liquid and the acrylic teeth chosen. We compared colour stability of two batches of homolog teeth, first unmodified and second grinded and polished in the dental laboratory, from which the most affected were R and M where this colour change occurs in three of the four kinds of drinks in which we have made the immersion. Washing the dentures with soap and water reduced differences in colour caused by contact with any type of these drinks.*

Keywords: color stability, denture, acrylic teeth, staining drink

Due to the increasing life expectancy, more and more people need partial or full dentures. Today, patients have a very good access to information and their expectations are higher than before, so the prosthetic restorations need to be aesthetic and to keep their appearance during the years they are functioning. An important factor in the aesthetic equation of the removable prosthetic treatment is represented by the artificial teeth, from which the acrylic ones are most used in general practice. Despite the fact that most manufacturers tried to improve the mechanical qualities and the stain resistance of the acrylic denture teeth, the choice is still a difficult one for the dentist, but also important because of the psychological effect it has on the patient. If the aesthetic result of the prosthetic treatment is stable during the functioning years of the denture, the patient's satisfaction will help him to keep a positive attitude. Instead, changes in colour of the artificial teeth will lead to stressful age-related perceptions and will low the patient acceptance of the removable partial or full dentures. In this study we tried to assess the colour stability of acrylic denture teeth (half of them leaved untouched and the other half being modified in the dental laboratory) after exposure to stains from red wine, coffee, Coca Cola and black tea, and also the effect of daily hygiene (water and soap) after the artificial tooth discoloration.

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Experimental part

Materials and Methods

For our study, the same operator determined the colour coordinates using the Easy-Shade intraoral spectrophotometer. The results were expressed using CIELAB color notation system. Colour difference were expressed as ΔE * and were calculated using the formula $\Delta E^* = \sqrt{\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}}$ or $\Delta E = \sqrt{\Delta L^{*2} + \Delta C^{*2} + \Delta H^{*2}}$ where the ΔL* signifies the difference in brightness, Δa* color difference red-green, Δb* colour difference yellow-blue, ΔC* difference of colour intensity and Δh* difference of hue angle. We used all the right central incisors (1.1) unmodified, as they were purchased from manufacturers and all left central incisors (2.1) with the buccal face modified, knowing that during the manufacturing phases the dental technician reduces the surfaces of the teeth in order to fit them into the available space and to engage properly with the antagonists. We considered useful to assess how all these operations can alter the colour stability of artificial teeth. All determinations were made for both situations.

Artificial teeth

For this study were purchased six boxes of identical front superior acrylic denture teeth from four different manufacturers, a total of 24. We choose big size, same color (A2) teeth, very similar in size and shape. From each

Type of teeth	ΔL water miliQ	ΔL wine	ΔL Coca Cola	ΔL coffee	ΔL tea
V1	0	-1.2	1.8	1.2	1.7
V2	-0.4	-1.5	0.1	0.1	0.3
M1	-0.2	-0.9	-0.5	-0.5	-0.4
M2	-0.2	-0.9	0.2	O.2	0.3
R1	-0.1	1.1	1.6	1.6	0.9
R2	-0.4	0.3	2.8	2.8	2.2
S1	-0.1	-1.3	4.7	4.7	2.2
S2	-0.3	-1.3	4.8	4.8	1.5

Table1
THE DIFFERENCE IN BRIGHTNESS ΔL AFTER 7 DAYS

Type of teeth	ΔL water miliQ	ΔL wine	ΔL Coca Cola	ΔL coffee	ΔL tea
V1	O.1	-1.4	3.4	0.1	2.1
V2	-0.3	-1.8	2.5	-1.5	0.8
M1	0.5	-1.7	0.1	-2.8	-0.7
M2	0.1	-2.6	0.6	-3.9	-0.3
R1	0.1	1.7	2	-1.4	0.6
R2	0.5	0.6	3.4	0.3	2.7
S1	0.1	-1.6	5.3	5.5	1.4
S2	0.4	-1.9	5.3	0.5	1.6

Table 2
THE DIFFERENCE IN BRIGHTNESS ΔL AFTER 14 DAYS

box were selected for the experiment only teeth 1.1 and 2.1. Tooth 1.1 was used unmodified while the central third of the buccal surface of tooth 2.1 was prepared in the dental laboratory, grinded and polished as it is done in the usual manufacturing phases of the dentures, in order to adapt to the space and occlusion.

The device for artificial tooth positioning and for directions of spectrophotometer stem measurement

A device was made for constant positioning the tooth versus the Vita Easy Shade spectrophotometer rod used to determine color changes in the central third of the buccal area. We purchased a plastic box having eight identical joined containers and in each of the eight articulated tops we made a circular hole with a diameter of 6 mm corresponding to the diameter of the rod. Inside the containers it was applied the same quantity of a hard impression material supporting and positioning the analyzed tooth. Curing of the material was made with the tooth properly positioned horizontally with the center third corresponding to the perforation of the top. During the experiment, each box was only used for the corresponding tooth, so it could be removed from the container and repositioned always in the same place, the spectrophotometer rod being always in touch with the same area of the tooth.

- Milli Q Water obtained using Directly Q UV Millipore
- Drinks with coloring properties: red wine "Fetească Neagră", (Romania, Dealu Mare); Coca Cola (Coca Cola HBC Romania SRL); Starbucks Coffee Medium Juicy & Complex Kenya; Lipton Earl Grey Black Tea Imperial Floral Citrus.
- Intraoral Spectrophotometer Advance Vita Easyshade (Vita Zahnfabrik Germany).
- Graduated polypropylene sterile containers with 15 mL capacity for the preservation of samples
- Stand for containers with a capacity of 40 containers.
- 10-mL sterile syringes used to put the drinks into sterile containers for storage of samples.
- Thermostat (incubator) Sanyo MCO 17AIC

We calibrated the spectrophotometer for the initial determination of the teeth's colour in CIELAB System. The coordinates are L (lightness), C (chroma), h (hue angle), a (color red-green) and b (blue-yellow color). The 40 graduated containers have been labeled. Each tooth box was by symbols: V, M, R, and S. The type of tooth (1.1 or 2.1) was noted as such: 1 for 1.1 and 2 for 2.1. The original state of teeth (prior to immersion in liquids) was coded as 0, the drinks in which will be immersed the teeth have received the following encodings: 1 for water, 2 for red wine, 3 for Coca Cola, 4 for coffee and 5 for black tea. For example: the tooth 1.1 from V immersed in Coca Cola will be labeled with V13. With the help of five sterile syringes, one for each drink tested (Milli Q water used as control group, red wine, Coca Cola, coffee and tea), we added 10 mL of liquid in each container, and then the teeth were immersed in accordance with the labeling of the containers. The stand containing the 40 containers has been introduced in the incubator where it was kept at constant temperature (37°) C. All drinks from containers were changed daily, tea and coffee were prepared daily and Coca Cola was opened daily, immediately prior to the filling of containers. After 14 days, all teeth undergoing the experiment have been washed with soap and water in order to reassess their change in colour.

Results and discussions

The differences in brightness ΔL

For identical teeth belonging to the same manufacturer, there are variations in ΔL, depending on the liquids and the period of immersion (table 1 and 2). Analyzing variations in brightness of the 4 types teeth 1.1 after 7 days of immersion, it was found that the biggest difference in brightness was seen in the S tooth immersed in coffee and in Coca Cola. The smallest ΔL was for R tooth after it was introduced in black tea. Compared to 1.1 teeth, the 2.1 teeth present the maximum brightness changes, higher or equal except the M teeth where the variations are lower than in the case of 1.1 teeth. Analyzing variations in brightness of teeth 1.1 of the 4 different boxes after 14 days it was found that the highest maximum brightness difference was seen in S (5.5), similar to the result obtained after 7 days evaluation of immersion. The lowest maximum ΔL was for R (3.9). Over 1.1 teeth, the 2.1 teeth present the maximum brightness changes, bigger for R (similar to the values after seven days) and M.

Type of teeth	ΔC water miliQ	ΔC wine	ΔC Coca Cola	ΔC coffee	ΔC tea
V1	-0.4	0.6	1.2	1.8	0
V2	0.2	3.8	-1.3	-0.2	-0.6
M1	-0.2	-2.2	0.8	1.2	-1
M2	-0.2	-0.9	0.6	3.9	2.8
R1	0.3	0.6	1.3	2.2	0.4
R2	-0.2	1.7	2.8	3.6	-1.2
S1	-0.2	0.9	-2.8	-2.6	-2.4
S2	0.4	2.5	-0.4	4.3	-1.9

Table 3
THE DIFFERENCE IN INTENSITY OF COLOUR ΔC AFTER 7 DAYS

Type of teeth	ΔC water miliQ	ΔC wine	ΔC Coca Cola	ΔC coffee	ΔC tea
V1	-0.2	0.5	1.3	4.6	0.8
V2	0.2	6.2	-1.8	1.4	-0.5
M1	0.4	-2.8	0.3	3.2	0.5
M2	0.3	-1.3	0.3	5.8	2.2
R1	0.5	0.6	1.6	3.9	0.8
R2	-0.2	1.1	4.1	-4.7	1.6
S1	0.3	3.9	-3.7	-1.4	-0.7
S2	0.4	3.6	-1.9	4	-1.6

Table 4
THE DIFFERENCE IN INTENSITY OF COLOUR ΔC AFTER 14 DAYS

The differences in intensity of color ΔC

The variations regarding the color intensity ΔC, depending on the solution in which the tooth was immersed and on the time of immersion, are shown in table 3 and table 4. For 1.1 teeth, after 7 days of immersion, the biggest difference of color intensity was recorded for S tooth, after immersion in Coca Cola. In the same solution, M tooth has the highest stability. The slightest variation in the intensity occurred for the immersion of V tooth in tea (ΔC = 0), also in tea the biggest change occurring for S tooth. For 2.1 teeth (modified in the laboratory) the maximum colour intensity variation in four types of drinks was greater than the one registered for 1.1 teeth, for all four types.

For the V tooth, after 14 days of immersion, the smallest variations in the intensity of the colour registers after immersion in wine, and the maximum one after immersion in coffee. Modification of the teeth causes larger variations of colour intensity at the immersion in Coca Cola and wine, compared with untouched teeth. The smallest changes in colour intensity for 1.1 teeth appear at immersion in Coca Cola, and the greatest at immersion in coffee. Modification of the teeth causes increasing colour intensity variations at immersion in coffee and tea. For the R teeth the smallest variations in the color intensity are after immersing in wine and tea, and the biggest after immersing in coffee. Modification of the teeth causes larger variations of the shade intensity in all types of drinks examined compared with untouched teeth. The smallest changes in colour intensity for 1.1 S teeth appear at immersion in tea, and the greatest after immersion in Coca Cola.

The differences in hue angle Δh

Differences in hue angle Δh depending on solution and period of immersion are shown in table 5 and table 6. After 7 days of immersion, V teeth present the smallest shade variations after immersion in wine and the biggest after immersion in Coca Cola. Wine and coffee cause greater shade variations for the V modified teeth (2.1) compared to those unmodified (1.1). The smallest shade changes for the 1.1 M teeth appear after immersion in black tea, and the greatest after immersion in red wine. Modification of the M teeth in the dental laboratory causes increased shade variations after immersion in all types of drinks except red wine, where the values are similar to the unmodified teeth. R teeth present the smallest shade variations after immersion in Coke and coffee and the biggest after immersion in black tea. All kinds of drinks cause greater variations of shade on modified R teeth (2.1) compared to those unmodified (1.1). The smallest shade change for 1.1 S tooth appears after immersion in red wine and biggest after immersion in coffee. Modification of S teeth causes increasing shade variations only after immersion in red wine. Hue variations are influenced by the type of solution in which was immersed the acrylic tooth. For the batch of 1.1 teeth, the greatest variation of hue has been registered in S teeth after immersion in coffee. Also in coffee, the smallest variation was registered for M teeth. The smallest change in hue was encountered in M teeth after immersion in black tea (Δh = 0), while the greatest hue changes was found in S tooth. The slightest shade variation after immersion in all the four drinks have been registered for M and R teeth and the biggest hue change was registered for

Type of teeth	Δh water miliQ	Δh wine	Δh Coca Cola	Δh coffee	Δh tea
V1	0.2	-0.2	1.2	0.2	1
V2	-0.2	-0.9	0.3	-0.4	-0.3
M1	-0.1	-0.8	-0.4	0.2	0
M2	-0.6	-0.6	0.7	-1.8	-0.3
R1	-0.4	0.4	0.2	0.2	0.8
R2	0.5	0.8	1.8	1.8	1.6
S1	0.5	1.1	2.2	2.4	2
S2	0.6	1.7	1.6	2.1	0.9

Table 5
THE DIFFERENCE IN HUE ANGLE Δh AFTER 7 DAYS

Type of teeth	Δh water miliQ	Δh wine	Δh Coca Cola	Δh coffee	Δh tea
V1	0.2	0.6	1.5	-0.6	0.6
V2	0.4	1.6	0.5	-1.5	0
M1	0.2	-1	0	-1	-0.7
M2	0.3	-4.2	0.8	-3.4	-0.9
R1	0.3	-0.7	0.2	-0.7	0.5
R2	0.4	1.1	1.6	4.7	1.7
S1	0.3	1.2	2.1	1.5	1.8
S2	0.1	0.7	0.5	-1.6	0.4

Table 6
THE DIFFERENCE IN HUE ANGLE Δh AFTER 14 DAYS

Type of teeth	ΔE water miliQ	ΔE wine	ΔE Coca Cola	ΔE coffee	ΔE tea
V1	0.3	1.52	1.52	1.77	1.74
V2	0.5	2.79	1.3	1.84	0.8
M1	0.5	1.58	0.94	1.22	1.07
M2	0.4	1.68	0.8	4	0.9
R1	0.3	1.34	2	2.8	1
R2	0.4	1.92	4	4.6	2.62
S1	0.3	4.37	4.9	5.5	3.4
S2	0.5	5.1	4.8	6.5	2.7

Table 7
THE COLOUR STABILITY ΔE AFTER 7 DAYS

S tooth. Hue variation for the batch of 2.1 teeth (modified) are smaller or greater than those recorded for 1.1 teeth depending on the type of drink in which were immersed and the manufacturer, excepting R teeth where Δh has much higher values for 2.1 in all drinks compared to those recorded for 1.1.

After 14 days of immersion, 1.1 V teeth presented the greatest hue change in Coca Cola. The 2.1 V teeth (modified) presented increased hue variations after immersing into the red wine and coffee. The greatest shade variation appeared in the batch of modified teeth immersed in red wine, with a value of Δh of 1.6. The greatest hue variation, recorded for M teeth 1.1, is obtained after immersion in red wine and coffee. Altering the dimensions of the M teeth by the technician (2.1 M teeth batch) increases hue variations after immersion in all four drinks used in this experiment. R 1.1 teeth presented the biggest hue changes after immersion in red wine and coffee. R 2.1 teeth presented bigger hue changes then 1.1 batch, in all types of drinks with the highest value for coffee. The 1.1 S teeth recorded the highest value of hue difference after immersion in Coca Cola. Altering the dimensions of the teeth (2.1 S teeth batch) results in increasing hue difference just in case of immersion in coffee, otherwise the values are lower.

Hue variations are influenced by the type of solution in which was immersed the acrylic tooth. For the batch of 1.1 teeth (unmodified), the greatest hue variation has been registered in S teeth, with a value of 2.1 after immersion in coffee. Also in coffee, the smallest variation appeared in M tooth (-1). The slightest hue change was encountered in M teeth after immersing in black tea (Δh = 0), while the greatest hue change was registered for S teeth. The lowest maximum value for hue variation, after immersion in all four staining drinks, was registered for R teeth (similar to values after seven days) and the biggest hue change was found for S teeth, similar to the determination after 7 days. Maximum shade variation in case of 2.1 teeth (modified in the dental laboratory), is higher than the one recorded for 1.1 M and R teeth.

The colour stability ΔE

The color stability ΔE of acrylic teeth depending on the staining drink is highlighted in table 7 and table 8. Color stability varies with the type of acrylic teeth and the type of drink. After 7 days of immersion, from the analysis of changes in the colour of 1.1 teeth (unmodifed), the greatest colour stability in red wine was for R teeth, in Coca Cola was for M teeth, in coffee was also for M teeth and in black tea was for M and R teeth. The smallest color stability in all 4 cases of immersion has been registered for S teeth. From all the 1.1 teeth (unmodifed) analyzed, the smallest color stability was registered for S teeth with a maximum value of ΔE 5.5 after immersion in coffee. The best colour stability was registered for M teeth with a maximum value of ΔE of 1.58 obtained after immersion in red wine. V teeth registered a maximum value of ΔE 2.2 in Coca Cola and R teeth registered a maximum value of ΔE 2.8 in coffee. The greatest stain capacity on the acrylic teeth from the 1.1 batch turned out to be that of the coffee followed by Coca Cola and red wine, while the smallest was that of the black tea.

The 2.1 teeth from the second batch (modified in the dental laboratory) has a range of less colour stability in wine, compared to the 1.1 teeth from the first batch (unmodified) for all four types of acrylic teeth. That difference colour stability is greater for V, R and S and smaller for M. The same situation is also found after immersion in coffee, with the greater differences observed for M and smaller for V. Color stability of teeth belonging to the 2.1 batch from R is lesser than that of the 1.1 batch of the same teeth for all kinds of staining drinks with. Coffee produces the biggest changes in colour of the 2.1 teeth of all manufactures, excepting V where the largest changes occur after immersion in red wine.

After 14 days of immersion the V unmodified teeth (1.1) present the lowest color stability after immersion in Coca Cola (ΔE 3.6) (fig. 1a). Altering the dimensions of the artificial V teeth by the technician (batch 2.1) causes a decrease in color stability in contact with all four solutions with staining properties. For example, only after immersion in red wine, the value of ΔE become 3.89, which is more than the maximum value of ΔE for V unmodified teeth (1.1).

Of all the solutions in which have been immersed, M 1.1 teeth type suffered the biggest color change after immersion in coffee (ΔE 4.28) (fig. 1b). Altering the dimensions of the artificial M teeth by the technician (batch 2.1) caused a decrease in color stability after immersion in coffee (ΔE 7.07) compared to the value recorded in the 1.1 batch, value that represents the lowest color stability of all

Type of teeth	ΔE water miliQ	ΔE wine	ΔE Coca Cola	ΔE coffe	ΔE tea
V1	0.3	2.7	3.6	3.5	2.28
V2	0.4	2.6	1.77	2.86	0.9
M1	0.4	2.33	1.04	4.28	1.68
M2	0.5	2.95	0.83	7.07	2.2
R1	0.4	3.34	2.56	4.17	1.18
R2	0.5	2.7	4.89	6.1	3.2
S1	0.3	5.4	5.91	5.82	3
S2	0.5	5.36	5.31	6.56	1.68

Table 8
THE COLOUR STABILITY ΔE AFTER 14 DAYS

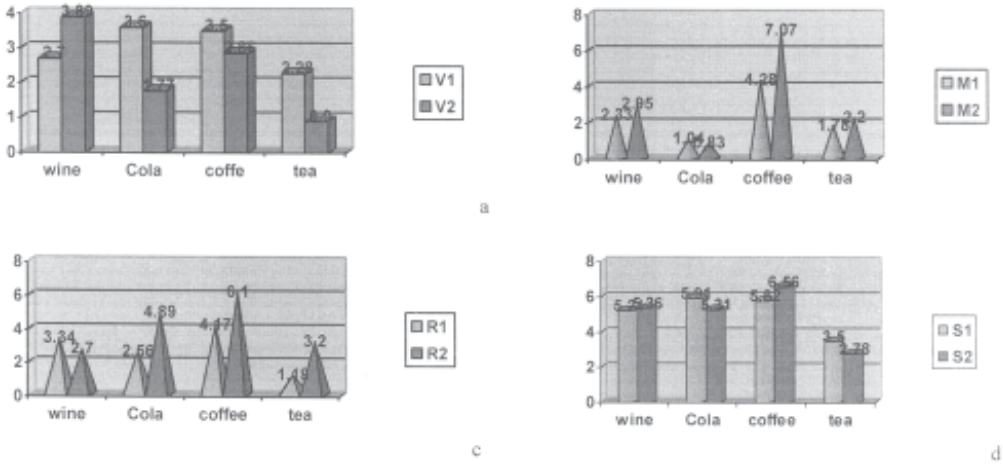

Fig. 1. Colour stability of teeth after 14 days: a – V; b – M; c – R; d – S

M teeth analized. The value of colour stability of the 2.1 modified teeth decreases also after immersion in black tea and red wine. Altering the dimensions of the artificial M teeth by the technician (batch 2.1) causes a decrease in color stability in contact with all four staining solutions.

The smallest colour stability is recorded by R 1.1 teeth after immersion in coffee (ΔE 4.17) (fig. 1c). Altering the dimensions decreases the color stability after immersion in all drinks except red wine (2.1 teeth). The maximum value of ΔE for these teeth, recorded after immersion in coffee, is ΔE 6.1.

Of all the staining solutions, the S teeth suffered the greatest colour change after immersion in Coca Cola (ΔE 5.91) (fig. 1d). Colour stability of S teeth decreases for the 2.1 batch teeth after immersion in coffee, black tea and Coca Cola, with a maximum value of ΔE 6.56 obtained after immersing in coffee. This value is greater than the maximum obtained for 1.1 batch of unmodified teeth. So we can say that altering the teeth' dimensions during laboratory phases causes decreases of color stability after immersion in all four solutions.

Results and discussions

A description of the colour can be made using three coordinates: brightness, color intensity and hue. CIELAB system, described in 1927, offers the ability to compare two colours. It is the most widely used system of measurement used in the field of dental medicine. Three dimensional color features are defined using three coordinates: L* lightness from black (-) to white (+), a* for red-green colour from green (-) to red (+) and b* for yellow-blue colour from blue (-) to yellow (+) [1]. It can be used an alternative method whose coordinates are lightness (L*), chroma (c*) and hue (h*). The difference of colour in CIE space is the distance between the colour positions. This difference is expressed as ΔE CIELAB where $\Delta E^* = \sqrt{\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}}$.

Studies made on colour stability of artificial teeth used for dentures led to the conclusion that they suffer colour changes in contact with oftenly ingested drinks which have staining properties such as: black tea, coffee, red wine or Coca Cola, regardless the type of artificial tooth [2]. Most of them used unmodified prefabricated acrylic teeth from various manufacturers. In our study we obtained similar results, introducing beside the batch of unmodified teeth, another batch of teeth which were grinded and polished by the dental technician. Studies reported by Koksai in 2008 [3], Mutlu-Sagesen in 2001 [4], Gregorius in 2012 [5] founded coffee as the most chromogenic agent. Akyil [6], as a result of a survey conducted in 2010, considered tea as more chromogenic than coffee or Coca Cola. Gregorius [5] reported in 2012 for V teeth a change in color of 1.8 in coffee and 0.9 in wine, after 7 days of immersion. The current study found for V teeth a ΔE of 1.77 in coffee, these teeth being the most stable in this solution, and 1.91 in red wine, in which V was surpassed by the stability of M teeth, after 7 days of immersion, so similar values to those obtained in other studies. After 14 days of immersion, ΔE values are 3.06 in coffee and 2.7 in red wine, which shows that the duration of immersion influence colour stability, in accordance with the results of the study of Akyil in 2010 [6]. After 14 days of immersion in the four coloring drinks, the most stable teeth proved to be V, followed by M, R and S. The originality of our research was to investigate the influence of grinding the teeth by the technician during the manufacture of the denture on the colour stability of artificial teeth. Current study shows that these changes affect the color stability by decreasing it. Determination of artificial teeth's weight before any immersion and after 14 days of immersion in drinks with staining properties does not show any modifications, so staining does not imply any weight changes.

Researches regarding dental aesthetics show a perceptibility level and an acceptability level of color changes (50:50 probability). The perceptibility is on level of ΔE 1.9 (1.7-2.1 range) after Algazali, in 2012, [7] and of 2.6, after Douglas in 2007 [8]. Acceptability (50: 50 probability) is assessed at a value of ΔE of 4.2 (3.9-4.4 range) after Algazali [7] and of 5.5 after Douglas [8]. In the

current study, the lowest ΔE recorded after 7 days of immersion (the best color stability) is evidenced by M teeth (1.58, below perceptibility level), when the lowest color stability showed S (ΔE 5.5, at the limit level of acceptability). M teeth show after 14 days a maximum ΔE of 4.28 above the level of perceptibility but under the level of acceptability, and S teeth had a ΔE of 5.9 which lies below the level of acceptability. After 7 days V teeth presents a ΔE of 1.91 below perceptibility level and R teeth a maximum ΔE of 2.8 slightly above the level of perceptibility but under the acceptance. V teeth had a maximum ΔE of 3.6 after 14 days, perceptible but acceptable, while R teeth had a maximum of ΔE of 4.17 also perceptible but acceptable. After 7 days there are no perceptible colour changes for M and V teeth while color changes are perceptible but acceptable in case of R and S teeth. At 14 days, colour variations of all teeth are discernible. They are also acceptable, excepting S teeth. Washing with soap and water decreases the color differences so that S teeth reached a ΔE of 5.4 after cleaning, making them perceptible but acceptable.

Perez, in 2011 [9], defines as acceptable a brightness variation of 2.95, and Ghinea in 2010 [10] a variation of 2.44. After 7 days, all the studied teeth studied presented acceptable variations excepting S teeth. At 14 days all the studied teeth presented differences in brightness, slightly outside the level of acceptance. Acceptable differences of intensity of color are, after Perez [9], at a value of 2.52 and after Ghinea [10] at a value of 3.15. After 7 days of immersion all studied teeth are at the level of acceptability and after 14 days, all are above this level. Variations in shade are becoming unacceptable at a value of Δh of 1.9 after Ghinea [10]. So after 7 and 14 days, just S teeth are situated above the level of acceptability.

After Gregorius [5], an immersion of 7 days is the equivalent of a contact of acrylic teeth with drinks with staining properties for 10-15 min daily, for 34 to 67 months, an average of 4-5.5 years. So, for 4-5 years, colour changes of teeth studied are considered acceptable, and those of M and V are not even perceptible. After 8-11 years, they become visible to all the teeth, but unacceptable just for S. Washing with soap and water determine the changing colors of S teeth to be acceptable even after 8-11 years.

Conclusions

Reducing of the artificial teeth in order to fit the space available for them on the oral cavity, followed by finishing and polishing in the laboratory, change their colour stability, by decreasing it. This procedure is a mandatory stage for occlusal and gingival adaptation of the acrylic teeth during the fabrication of any type of denture. Prefabricated acrylic teeth suffer changes in color when they come in contact with drinks ingested by the largest part of the population. The magnitude of these changes is dependent on the type of these drinks. Our study shows that, of the four analyzed drinks, the most coloring is coffee. Color stability of acrylic teeth is inversely proportional to the duration of the contact with those staining drinks. Washing the dentures with soap and water reduces differences in colour caused by all these types of solutions.

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Manuscript received: 30.09.2013