

ORIGINAL ARTICLE

Over the counter bleaching products versus home remedies

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ABSTRACT

Background: Individuals conform to a perfect smile depending on the condition of their teeth, thus contributing to their overall appearance.

Objective: The current study aimed to check the efficiency of teeth whitening with different materials and measure the effect of roughness of each material in natural human teeth.

Methods: The study was conducted on 30 samples of teeth, including incisors, premolars, and molars, from both males and females, extracted due to orthodontics or periodontics procedures. Teeth were divided into three groups. Each group was washed with different materials daily for one minute for a period of 3 weeks.

Results: After testing and measuring through a spectrophotometer, a significant change was noted between the whitening toothpaste and lemon and baking soda by 0.002 and charcoal toothpaste by 0.012. However, the whitening toothpaste and the charcoal toothpaste showed no significant differences. Contour GT-K machine for roughness measurement showed that the lemon and baking soda increased and then declined to a very smooth surface. However, the whitening toothpaste showed high roughness, whereas the charcoal toothpaste maintained a stable rough surface.

Conclusion: Most people are concerned about aesthetics and seek to improve it either through safe or unsafe ways. Most people look for easy ways to get teeth whitening, either through home remedies or over-the-counter products. However, charcoal toothpaste showed the most effective color change and is less abrasive than whitening toothpaste and lemon, and baking soda.

Keywords: OTC, bleaching, home remedies.

Introduction

Individuals conform to a perfect smile depending on the condition of their teeth, thus contributing to their overall appearance. Stained teeth with components covering the enamel remain a nuisance to individuals. Therefore, they sort for tooth whitening techniques. In the past, there have been several approaches to treat discolored teeth, including composite resin restoration, bleaching, and crowns [1]. There have been in-office bleaching and take-home techniques that individuals employ with materials choice while considering the time factor for producing results.

Additionally, the use of resin components has been on the rise as materials for restoration since they pose excellent aesthetic properties [2]. One of the elements that damage tooth is surface roughness, thus requiring whitening. It

impedes the reflection of the light portraying some dull appearance that delineates it from the rest of the teeth.

There exist several natural ways of teeth whitening, and people often consider them based on the requirements. The first is making dietary changes, including eliminating foods that cause staining [3]. Such foods include wine, tea, dark sodas, and juices. The second method is oil

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pulling, which involves washing the mouth with oil to remove dirt and bacteria. Oils suitable for this purpose include coconut, sesame, and sunflower oil. The third method includes brushing with baking soda, which smoothly polishes the stains away from the tooth surface. The fourth method is the use of hydrogen peroxide for its mild bleaching property [4]. However, it has the potential to increase tooth sensitivity; thus, it should not be used for a long-time. Finally, one can maintain oral hygiene through regular brushing and taking fruits that help improve whitening [5].

Zimmer et al. [6] conducted a test on acidic beverages and found their overall influence on teeth staining. From the samples collected, lemon juice showed significantly high erosivity on the tooth than any other material. They also noted some variation in the level of erosivity among the non-alcoholic drinks they used. In the teeth whitening remedies, Lora Dodge proposed lemon juice as an important whitening material due to the presence of nitric acid intrinsic in its body.

Materials and Methods

An array of materials and techniques were available to foster the research process. These include 30 extracted sound teeth, charcoal toothpaste, whitening toothpaste, lemon and sodium bicarbonate, medium bristle electric toothbrush, photo spectrometers, and contour GT-K 3 Optical for imaging and characterization

The research was both qualitative and quantitative as there were different variations that the research intended to achieve. Recording and tabulation of color change and roughness level results were performed using quantitative analysis, which involved manual placement of a sample on the GT-K 3D optical microscope stage. It has an internal software controlling data analysis, the setting of the instrument, and the output of the graphs. The sample was regulated to an appropriate level. After that, measurements used vertical scanning interferometry to ensure the extent of the surface roughness. Scanning was performed at different times to find data from which a mean value was calculated. The mean value forms the basis for the derivation of standard deviation (SD) and other parameters.

In the qualitative research and analysis, interviews, with both open-ended and closed-ended questionnaires, were conducted. In another sphere, interviews to obtain information relevant to teeth whitening were conducted. Before the interviews, we ensured adherence to all the relevant ethical considerations, such as confidentiality of information. The study group was also organized into different demographic characteristics, such as age, sex, marital status, and education level, to determine the distribution of our target audience for a more in-depth quantitative analysis. This was important as it highlighted differences that exist among several cases. The duration of the study was 4 weeks.

Results

In the beginning, 500 respondents were interviewed in the first 2 weeks, with some being non-smokers but a vast majority ardently partaking in tea and coffee.

Among the participants, 35.35% were within the age range of 15-25 years, 29.3% were 26-35, 17.4% were 36-45, and 18% were over 45 years. The participants included 72.25% of females and 27.8% male, 41.1% single, and 54.4% married. Regarding the educational level, college, and higher constituted 74.9% of participants, while those in high school and lower constituted 25.1% of participants. Considering employment status, 55.8% of the sample were unemployed, with 21% working in the private sector, and 23.2% working for the government. Finally, 19.3% of the respondents were smokers, while 80.7% were non-smokers.

Regarding the assessment of teeth condition, 18.7% of participants had excellent, 60.8% had good, and 20.5% had teeth in bad condition. Among the participants, 22.4% used teeth whitening in dental clinics, while 50.4% used it at home. A significant number of participants (27.2%) also used it either at home or in clinics. Regarding the common materials used for teeth whitening, 2.9% of the sample used charcoal, 2.3% used bicarbonate and lemon, 75.9% used different kinds of toothpaste, whereas 15.8% used teeth whitening strips.

For the quantitative analysis of color change and roughness, results from the GTK microscope were tabulated, and comparisons were made based on SD from the initial mean value of the initial week (Table 1).

Table 1 shows the L , a , and b values for the various samples used to indicate variations in sample colors. L denotes lightness and darkness of the sample, with the positive value showing lightness and the negative value showing darkness. The " a " denotes how green or red the samples are, and " b " denotes the yellow and blue color of the sample (Table 2).

Table 3 shows the original value of mean color from the first week, forming the basis for variations. The SD records any changes in color due to the use of different over-the-counter homemade materials.

Table 4 shows the variations in surface roughness of the stained teeth. Poor whitening shows that whitening materials have to remove rough surfaces created by teeth stain for proper whitening. The initial roughness from the contour GT Microscope forms the baseline for variations when using different materials. The material with the greatest variation will be the one having the most effective whitening.

This pairwise combination analysis showed that the whitening toothpastes are more effective than lemon and sodium bicarbonate, contrary to its ease of use. These can conform to the results of the survey that has the highest percentage of users.

OTC bleaching versus home remedies

Table 1. Mean and SD of different groups at different intervals.

Coordinates	Weeks	Charcoal powder		Whitening toothpaste		Lemon & sodium bicarbonate	
		Mean	SD	Mean	SD	Mean	SD
L*	Week 1	68.74	3.27	70.36	4.46	68.30	5.39
	Week 2	69.21	4.69	68.24	6.30	61.50	4.26
	Week 3	69.78	4.94	66.12	4.14	64.89	4.08
	Week 4	76.84	3.00	73.95	3.47	66.05	5.47
a*	Week 1	-2.47	0.64	-2.18	0.57	-2.39	0.38
	Week 2	-3.02	0.58	-3.01	1.03	-2.77	0.44
	Week 3	-2.92	0.41	-3.43	0.90	-2.69	0.37
	Week4	-2.60	0.50	-2.78	0.95	-2.53	0.39
b*	Week1	4.61	3.65	3.12	3.70	3.74	3.42
	Week2	5.08	5.12	2.30	3.94	2.65	3.41
	Week3	4.28	4.56	1.36	4.43	2.76	2.84
	Week4	4.66	3.90	2.42	4.97	3.23	3.61

Table 2. The variation in color of the samples.

Coordinates	Weeks	Charcoal powder		Whitening toothpaste		Lemon & sodium bicarbonate	
		Mean	SD	Mean	SD	Mean	SD
ΔL	After 1 week	0.46	4.48	-2.12	8.59	-6.80	2.06
	After 2 weeks	1.03	5.83	-4.24	4.77	-3.41	2.42
	After 3 weeks	8.09	2.93	3.59	6.77	-2.25	3.91
Δa	After 1 week	-0.55	0.25	-0.83	1.38	-0.38	0.31
	After 2 weeks	-0.44	0.44	-1.25	1.19	-0.30	0.27
	After 3 weeks	-0.12	0.19	-0.60	1.30	-0.14	0.28
Δb	After 1 week	0.47	2.03	-0.82	5.69	-1.09	0.51
	After 2 weeks	-0.33	1.41	-1.76	6.23	-0.99	1.36
	After 3 weeks	0.05	1.34	-0.70	6.69	-0.51	1.02

Table 3. Comparison of mean color change by analysis of variance.

		N	Mean	SD	Std. error	95% confidence interval for mean		F	p
						Lower bound	Upper bound		
After 1 week	Charcoal powder	10	4.27	2.20	0.70	2.69	5.84	2.959	0.069
	Whitening toothpaste	10	8.42	5.98	1.89	4.14	12.69		
	Lemon & sodium bicarbonate	10	6.92	2.05	0.65	5.46	8.39		
	Total	30	6.53	4.12	0.75	5.00	8.07		
After 2 weeks	Charcoal powder	10	5.26	2.63	0.83	3.38	7.15	4.550	0.020
	Whitening toothpaste	10	8.02	4.07	1.29	5.10	10.93		
	Lemon & sodium bicarbonate	10	4.12	1.73	0.55	2.89	5.35		
	Total	30	5.80	3.32	0.61	4.56	7.04		
After 3 weeks	Charcoal powder	10	8.20	2.92	0.92	6.11	10.29	8.015	0.002
	Whitening toothpaste	10	9.11	3.92	1.24	6.31	11.91		
	Lemon & sodium bicarbonate	10	3.79	2.53	0.80	1.98	5.60		
	Total	30	7.03	3.87	0.71	5.59	8.48		

Table 4. Comparison of mean surface roughness among different study groups.

		N	Mean	SD	Std. error	95% confidence interval for mean		F	p value
						Lower bound	Upper bound		
Week-1	Charcoal powder	10	4.30	1.78	0.56	3.03	5.57	2.037	0.151
	Whitening toothpaste	9	6.01	1.74	0.58	4.67	7.35		
	Lemon & sodium bicarbonate	10	5.40	2.09	0.66	3.91	6.90		
	Total	29	5.21	1.95	0.36	4.47	5.95		
Week-2	Charcoal powder	10	6.44	2.06	0.65	4.97	7.92	1.629	0.215
	Whitening toothpaste	9	7.91	1.89	0.63	6.45	9.36		
	Lemon & sodium bicarbonate	10	6.81	1.48	0.47	5.75	7.87		
	Total	29	7.02	1.87	0.35	6.31	7.73		
Week-3	Charcoal powder	10	4.58	1.39	0.44	3.59	5.57	1.727	0.197
	Whitening toothpaste	10	5.87	1.81	0.57	4.57	7.16		
	Lemon & sodium bicarbonate	10	5.33	1.44	0.46	4.30	6.36		
	Total	30	5.26	1.60	0.29	4.66	5.85		
Week-4	Charcoal powder	10	2.63	0.70	0.22	2.13	3.13	10.216	0.000
	Whitening toothpaste	10	5.01	1.53	0.48	3.91	6.10		
	Lemon & sodium bicarbonate	10	4.76	1.48	0.47	3.70	5.82		
	Total	30	4.13	1.65	0.30	3.51	4.75		

Discussion

The interviews indicated that most people used teeth whitening at home rather than in clinics, with a higher number of people preferring whitening toothpaste [7]. This shows that ease of use is the first determinant of choice when considering whitening material. For example, people tend to prefer the paste for its ease of use between charcoal paste and charcoal powder. The paste is soft, while powder presents difficulties in application, rinsing and may exist in larger particles that may be a nuisance to brushing [8]. Few respondents were using other whitening methods showing that contemporary toothpaste makes the feasible alternative for most people. We noted that most people prefer home whitening since visiting a clinic comes with expenses that render it economically unsound for them [9]. Additionally, the number of smokers in the sample was low, while a larger percentage was taking tea and coffee, which shows that common teeth whitening problems result from having stain susceptible foods.

From the quantitative study, variation in different results for the materials was noted. The *L*, *a*, and *b* values for charcoal toothpaste, whitening toothpaste, and lemon and sodium bicarbonate show both positive and negative variations. For “*L*” values, positive shows how light the materials are, while negative shows their dullness, a positive value of “*a*” shows the quantity of red, while negative value shows the amount of color green. For “*b*,”

the positive value shows the quantity of yellow color, while the negative shows blue color dominance. Color tests for 4 weeks provided variations in teeth color during the use of whitening materials mentioned above. These parameters also provide the relevant information critical for determining color changes, thus giving the most effective material to use.

The correlation between bleaching character and color depends on the material used. Short-term bleaching brings about positive results in whitening with smoother tooth surfaces [10]. However, the results show that continuous use can be detrimental as it renders the surface rougher and promotes future susceptibility to discoloration. Moreover, the bleaching of discolored restorations increases the surface roughness of teeth. Therefore, using some materials, such as Luma White Plus, should be limited to short-term use.

Whitening procedures are of the essence in cases where there are stains on the surface of the enamel, thus limiting its reflective nature that inhibits attractiveness. The qualitative analysis through interviews shows that the number of people taking tea and coffee is high, showing them as a significant bane to whitening among populations. Most people, particularly women, use bleaching remedies for teeth whitening to improve their aesthetic appearance [10]. We also see the predominance of home remedies among the populations citing the high expenses associated with sorting clinical interventions.

Similarly, tooth roughness was measured predominantly on the enamel surface. The variation between polished and unpolished enamel shows the overall variability in roughness and potentiality of causing teeth erosion due to whitening. We also see that tooth roughness depends significantly on the type of bleaching agent in use [11].

Among the materials, toothpaste gave the best effective results following the limited teeth surface roughness. However, it contributes to a moderate whitening of the color shade. On the other hand, the whitening toothpaste has a higher level of whitening in terms of color shade but with a medium roughness [12]. The lemon and sodium bicarbonate promote staining rather than whitening of the tooth [13]. However, it produced the smoothest surface with the lowest roughness than other materials. Therefore, since all the materials have advantages and setbacks, it is essential to use them in combination such that one material rectify the limitations of the other.

Conclusion

In the current study, measuring unpolished and polished enamel was representative of the overall enamel surface roughness before and after erosion. Increased surface roughness of teeth as a result of bleaching appears to be dependent on the bleaching agent used. Charcoal toothpaste gave the best effective result due to the lower level of tooth surface roughness with moderate whitening in color shade. Moreover, whitening toothpaste contributes to a higher level of whitening in the color shade with moderate roughness, whereas, lemon and sodium bicarbonate promotes staining rather than whitening the teeth.

Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent to participate

Not applicable.

Ethical approval

The study was approved from the IT of Riyadh Elm University [rc/irb/2019/311] with a date of 21/1/2021.

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