Original Article

EFFECT OF BANANA PEELS ON DENTAL BLEACHING: AN IN VITRO STUDY

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ABSTRACT

Dental bleaching has become one of the most demanding dental procedures for patients with high esthetic concerns. This research determined how well banana peels worked as a dental bleaching agent compared to traditional bleaching gels that included 35% hydrogen peroxide (HP). For a total of fifteen permanent incisors, three groups (GI, placebo; GII, 35% HP; and GIII, banana peels) were allocated at random. There were three 45-minute bleaching treatments. A visible ultraviolet light spectrophotometer was used to measure color changes (ΔE, ΔL, Δa, and Δb) seven days after each bleaching treatment. We used Tukey tests and analysis of variance with a significance threshold of 5% to compare the mean ΔE, ΔL, Δa, and Δb values across groups. Compared to the banana peels group and the control group, the groups treated with 35% HP exhibited greater ΔE and ΔL and lower Δb values for ΔE. Banana peels have a modest and statistically negligible bleaching effectiveness ($p<0.61$). There is little bleaching impact from using banana peels.

Key words: Dental bleaching, Teeth whitening, Natural teeth whitening, Banana peels, Hydrogen peroxide.

Introduction

Dental bleaching has become one of the most demanding dental procedures for patients with high esthetic concerns [1-3]. Dental stains could be influenced by intrinsic or extrinsic factors [4]. However, these factors should be carefully assessed to achieve optimal treatment results.

Large number of people are complaining of discolored teeth. There are several treatment options to overcome this complaint. These treatment options include dental bleaching, veneers, and crowns [5].

Dental bleaching has the advantage of being a more conservative approach among the others [6-8].

Peroxide-based agents like hydrogen peroxide and carbamide peroxide have been known for their strong effect on the bleaching of stained teeth [9].

However, a lot of people are searching for natural, cheap, and simple ways to get their teeth bleached. Therefore, recently, a lot of people have turned to using fruits for teeth whitening, as they are readily available, inexpensive, and easy to use. Several studies were done on different types of fruits [7, 10-13].

Nowadays, teeth whitening using banana peels has become a popular natural bleaching method. Many people have applied this experience to get whiter teeth at the lowest cost. There are no adequate studies on the use of banana peels for teeth whitening. Patients these days are expecting more and more from dental aesthetics. People who have whiter teeth are better accepted by society and are happier with how they look. On the other hand, tooth color variations over time are normal. In this context, the goal of oral hygiene is to preserve dental aesthetics by eliminating extrinsic stains brought on by the acquired pigmented pellicle, which is associated with the patient's age, eating, and hygiene habits. These elements affect the color and surface changes of teeth either alone or in combination [2-4].

Every day, new videos and profiles appear on the internet endorsing the use of homemade tooth whitening products, with the promise of quick and inexpensive dental bleaching, due to the current unachievable beauty standards and social pressure communicated through social media. However, there is no scientific proof of these products' effectiveness or safety for oral health [7, 8]. Among the naturally endorsed goods are banana peel, turmeric, and activated charcoal.

It's customary to think of banana peels as residue. Nonetheless, they include significant components with anti-inflammatory and antioxidant qualities, such as saponins, quinones, alkaloids, tannins, and flavonoids [13, 14]. Additionally, banana peel extracts have antibacterial action against oral disease-causing bacteria. The lack of studies on the use of banana peels and other fruits on teeth whitening has necessitated the need for experimental trials to evaluate their effect on dental bleaching.

Aim of the study

The purpose of this research is to assess how well banana peels bleach teeth.

Materials and Methods

The experimental design for this in vitro study included three different bleaching gels (bean skin, 35% hydrogen peroxide [35% HP], and placebo [control]). Three assessment time points (T0 [before bleaching], T1 [7 days after the first bleaching session], T2 [7 days after the second bleaching session], T3 [7 days after the third bleaching session]).

A total of 45 permanent incisors will be randomly split into three groups, n=15 for each group **(Table 1)**.

Table 1. Splitting the test groups based on the chosen bleaching treatment

Groups	Sample n	Bleaching product
G I	15	placebo
G II	15	HP 35%
G III	15	Banana peels

Specimen preparation
This involves cleaning all teeth with periodontal curettes and prophylaxis using a pumice and water solution. The cleaned teeth will be maintained in physiologic saline with 0.1% thymol and refrigerated at about 4°C until the experiment begins in order to inhibit the growth of germs.

Selection and pigmentation of samples
The process of selecting and pigmenting the samples will begin with an initial measurement of the value of L* utilizing a Visible Ultraviolet Reflection Spectrophotometer device after the storage time. We'll figure out the average of all the samples. After that, the groups will be kept under observation for six days, with daily infusion solution changes, in Eppendorf tubes with a 1-mL black tea infusion. As previously mentioned, a second color measurement will be taken after the pigment treatment. Afterward, 45 teeth with pigmentation will be chosen for examination based on the ΔE values. Following black tea coloring, the specimens will be rinsed with distilled water for six days to get rid of any leftover black tea, and then they will undergo pumice and water prophylaxis to get rid of any remaining surface stains. The specimens were chosen in a manner that standardized their original hue and level of pigmentation, which made it easier to standardize the specimens' ability to bleach teeth.

Treatment for bleaching
The following groups (n=15 each group) will be randomly allocated to the 45 stained teeth: GI, Control (Saline); GII, 35% HP; and GIII, Banana Peels. They will undergo the aforementioned analytical exam at the conclusion of each time frame.

Measurements of color shift
The samples will undergo color testing using a spectrophotometer that measures visible ultraviolet light. The following times will have the color measurements taken: T0 before the bleaching treatment; T1, seven days after the first bleaching session; and T2, seven days following the second bleaching session. The formula for calculating the color distance between two locations in the CIE system L*, a*, b* is as follows:

$$\Delta E = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]^{1/2} \quad (1)$$

Statistical analysis
We performed statistical analysis using SigmaPlot version 15.0 (Systat, San Jose, CA, USA). A power analysis was done to establish the sample size for each experiment group; a group size of n=15 offered a power of at least 0.826 at a significance level of 0.05. The data passed the normalcy test in all cases. The study used ANOVA with three-way repeated measurements and Tukey's post hoc testing to compare groups within different time intervals.

Results and Discussion

Table 2 demonstrates that at all analysis time points (T1, T2, and T3), the group that received whitening gels (GII) exhibited consistent and progressive color alterations. GI and G III group specimens, on the other hand, did not exhibit any appreciable variations during the course of the investigation **(Table 2)**. Comparing the groups at each time point revealed that, at T1, the groups treated with 35% HP had more chromatic modifications that were statistically significant when compared to the other groups. Furthermore, the group that got placebo gel at T1 showed the lowest levels of ΔE (GI), whereas the group that received banana peels (GII) had intermediate values. The outcomes at T2 resembled the ones mentioned at T1. The groups treated with 35% HP gel (GII) showed more chromatic alterations at treatment completion (T3) than did the other groups. The values of the GI and GII specimens were significantly different from one another as they were at T2.

Table 2. Mean values (SD) of ΔE under various settings for experiments and assessment intervals

Groups	T1	T2	T3
G I	01.20 (0.45) C a	01.50 (0.41) D a	01.20 (0.55) D a
G II	9.30 (3.68) A b	14.69 (4.69) A a	15.10 (4.21) A a
G III	2.25 (0.77) C a	2.40 (0.86) C a	2.75 (1.01) B a

According to statistical analysis, means that are followed by different letters indicate significant differences (p,0.05). Uppercase letters denote statistical differences between rows within a column, whereas different lowercase letters indicate statistical differences between columns in the same rows. We used the Tukey test and a three-way repeated-measures ANOVA.

Throughout the investigation, the GI and GIII specimens retained their luminosity, according to an analysis of ΔL **(Table 3)**. Under the second experimental condition, ΔL values increased over time in a steady and progressive manner. The ΔL value of GIII was comparable to that of the groups who got the placebo product (GI) at T1, and the groups that received bleaching gels had similar values. At T2, treatments with higher concentrated gels (GII) produced the greatest ΔL results. Values were lowest in the GI and GIII treatments using banana peels and placebo gel. At T3, all whitening gel treatments (GII) produced values that were comparable to and different from the groups that were treated with banana peels (GI and GIII) and a placebo gel.

Table 3. Mean values (SD) of ΔL under various experimental setups and assessment intervals

Groups	T1	T2	T3
G I	0.29 (0.73) B a	0.40 (0.81) C a	00.16 (0.97) B a
G II	9.30 (3.68) A b	14.69 (4.69) A a	15.10 (4.21) A a
G III	2.43 (3.62) B b	3.40 (0.86) B a	3.75 (1.01) B a

According to statistical analysis, means that are followed by different letters indicate significant differences (p,0.05). Uppercase letters denote statistical differences between rows within a column, whereas different lowercase letters indicate statistical differences between columns in the same rows. We used the Tukey test and a three-way repeated-measures ANOVA.

Table 4 demonstrates that at time T3, Δ levels decreased in every group. Comparing the groups' efficiency at each time point revealed that they performed similarly, with the group receiving banana peel treatment obtaining the highest results and the group receiving 35% HP gel producing the lowest values.

Table 4. Mean Values (SD) of Δ the different experimental conditions and evaluation times

Groups	T1	T2	T3
G I	0.66 (0.41) A a	0.75 (0.57) A a	0.47 (0.42) A b
G II	− 1.65 (0.88) B a	−0.67 (1.03) B a	−1.79 (1.20) B b
G III	1.31 (1.52) A b	1.48 (1.66) A b	1.75 (1.80) B b

A statistical analysis reveals that means with different letters after them denote statistically significant differences (p,0.05). Different lowercase characters indicate statistical variances across columns in the same rows in a set, whereas uppercase letters suggest statistical differences between rows within a column of data. We performed a three-way repeated-measures ANOVA along with the Tukey test.

Table 5 demonstrates that over the duration of therapy, Δb values decreased for every group, with the exception of the GI and GIII values, which did not change. T1 showed the lowest levels of Δb in the comparison of the groups after treatment with bleaching gels. The group that had bleaching gel (GII) had the lowest and most comparable results at T2. The group was treated with bleaching gel (GII) at T3.

Table 5. Mean Values (SD) of Δb in the different experimental conditions and evaluation times

Groups	T1	T2	T3
G I	0.61 (0.57) A a	0.28 (0.80) A a	0.06 (0.60) A a
G II	−2.15 (2.59) B a	−4.76 (2.32) BC a	−5.88 (3.21) C b
G III	1.2 (1.03) A a	0.95 (1.21) A b	−1.05 (1.45) B b

*A*ccording to statistical analysis, means that followed by different letters indicate significant differences (p,0.05). Uppercase letters denote statistical differences between sections within a single column, whereas different lowercase letters indicate statistical differences between sections on the same lines. We used the Tukey test and a 3-way repeated-measures ANOVA.

Prolonged studies have shown that while in-office bleaching procedures may quickly alter color, they can have serious negative effects [14, 15]. On the other hand, while at-home methods are also successful, they have certain drawbacks as well. These include the need for daily tray use, a slower rate of color change, and surface alterations in dental enamel that may make it more difficult for restorative materials to adhere because residual oxygen from bleaching product degradation will saturate the dental tissues [16]. According to Octarina (2017), 5% of the citric acid, gluaric acid, ascorbic acid (vitamin C), and polyphenols in lemon juice have the ability to whiten teeth [17]. Puspasari (2012) achieved a similar result by putting apple juice on teeth, allowing the enamel's surface to return to its natural color [18]. Sugianti (2012) revealed that rosella juice (hibiscus sabdariffa) may also be utilized as an alternative natural bleaching component since it includes high quantities of saponins and vitamin C. By using green pear juice [19], Diansari performed a study in 2019 and came to the conclusion that it was less successful at altering the color of teeth [20]. According to study results, banana peel extract (Musa paradisiaca var. raja) helps brighten teeth [21]. In a 2018 study, Maesaroh examined the effectiveness of banana peels as a natural whitening agent for discolored teeth [22]. According to the findings, the molars were immersed in banana peel extract for 14 days, during which time their hue altered in comparison to the brand's shade guide. The fact that banana peels contain a variety of components, including mineral and phytochemical components, has shown their ability to produce tooth discoloration [22]. Alkaloids, flavonoids, phenols, tannins, and saponins make up the phytochemical components of banana peel, while potassium, calcium, phosphorus, salt, magnesium, and iron make up the mineral components. In addition, banana peels also possess a pH of 6.7. Banana peels contain bioactive substances called saponins, which have the ability to bind chromogens and whiten teeth. Banana peels' high potassium and manganese contents are additional minerals that have teeth-whitening properties [22]. Yudhit (2019), who claimed that banana peels contain a variety of components, including mineral

and phytochemical components, supports this. In addition to having saponins, banana peels are cationic bio-sorbents that may brighten teeth color. Saponins are glucosides that have the ability to foam, creating foam that has cleansing properties [21]. The researchers state that several natural teeth-whitening agents may stain teeth based on many studies conducted. After being investigated by the researcher, this may happen due to numerous aspects of natural substances, notably the quantity, duration, and pH of a natural material. Because each tooth's enamel resistance varies, certain natural chemicals that cause stained teeth do not cause tooth discoloration. Thus, this factor has to be carefully considered as a natural whitening agent.

Conclusion

The methods using 35% HP provided the strongest bleaching impact, as we were able to show in our investigation. The bleaching effects of using banana peels are not very strong. The natural ingredients of banana peels contain compounds of saponins, malic acid, potassium, calcium, phosphorus, sodium, magnesium, and iron, while the phytochemical components of banana peels consist of alkaloids, flavonoids, phenols, tannins that can cause teeth whitening effect. This results in less effective bleaching because the thickness of the enamel on each tooth is different. Natural materials are less effective on posterior teeth because premolars and molars have a thicker enamel layer than anterior teeth.

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