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Research Article

Effect of Exposure to Yerba Mate during In-Office Bleaching Treatment

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Abstract

The aim of this study was to evaluate whether the intake of yerba mate tea during tooth bleaching reduces the efficacy of treatment. Twelve bovine teeth were used in the study. The initial color was analyzed using spectrophotometric measurement based on CIEL*a*b* colorimetry. The teeth were then immersed in Yerba mate for 15 days, changing the solution daily. After pigmentation, the teeth were submitted to a new spectrophotometric color analysis. The specimens were divided into two groups: Experimental Group (EG) and Control Group (CG). The Experimental Group was bleached using an in-office bleaching technique with Whiteness HP Automix bleaching gel (FGM, Joinville, SC, Brazil) for three 50-minute sessions with a 5-day interval, simulating a 30-minute daily consumption of yerba mate. Those in Control Group were only submitted to the bleaching procedure and the specimens were stored in a saline solution during the intervals. After treatment completion, the specimens were submitted to a new color analysis. The color measurements were analyzed using analysis of variance (ANOVA) and Tukey test with ΔE values for CG: 38.86 +- 11.88 EG: 40.8 +- 6.50 ($p = 0.72$). ΔL CG: 38.55 +- 6.25 EG: 36.64 +- 4.75 ($p = 0.56$). Δa CG: 3.89 +- 1.45 EG: 2.15 +- 1.57 ($p = 0.074$). Δb CG: -16.18 +- 5.83 EG: -17.36 +- 6.73 ($p = 0.75$). The present study showed that there was no influence of intake of yerba mate during tooth bleaching.

Keywords: Tooth Bleaching; Hydrogen Peroxide; Permeability of Dental Enamel; Stain

Introduction

Tooth darkening is one of the main factors that lead the patient to seek esthetic dental procedures. Thus, tooth bleaching is one of the most common in-office treatments to improve smile esthetics. The procedure is relatively simple and inexpensive [1].

Bleaching treatment depends on the correct diagnosis of the etiologic factor for color changes, in addition to knowing and mastering the different bleaching products, techniques and effects on the tooth structure and dental tissues. Depending on the recommended technique, the procedure can be performed in the dental office by a dentist or at home by the patient, but the concentration parameters and time of use are different [2-5]. The most common at-home bleaching gels are 15 - 22% carbamide peroxide and 6 - 9.5% hydrogen peroxide, but 35 to 40% hydrogen peroxide is used in in-office bleaching procedures. The most

common bleaching agent used in in-office techniques is 35% hydrogen peroxide. Besides being faster and 2.76 times more efficient than carbamide peroxide, it is considered more practical because bleaching can be performed in 3 or 5 sessions [5,6].

Tooth darkening can be caused by extrinsic pigmentation due to intake of coffee, red wine, among other products. Yerba mate (*Ilex paraguariensis*) could be one of the main causes of tooth darkening, as it is an important product in the economic and cultural context in southern Brazil [7,8]. Chimarrão (yerba mate beverage) is the most widespread form of consumption of yerba mate and 30%, on average, of the South American population consumes more than 1 liter/day of the beverage [8].

It is common for dentists to advise their patients not to ingest foods containing dyes to prevent staining since their teeth become more permeable during bleaching treatment [9]. However, it has been found that the intake of coffee during bleaching did not influence the success of treatment [1,11], so it is interesting to investigate if other products would.

Aim of the Study

The aim of the study was to evaluate whether the intake of yerba mate during tooth bleaching reduces the efficacy of treatment. The null hypothesis was that the concomitant intake of yerba mate and tooth bleaching does not affect the final color.

Materials and Methods

Twenty-five bovine teeth with intact crowns were cleaned with periodontal curettes, rubber cup, and pumice stone on a low-speed handpiece, washed in distilled water, and dried with gauze.

The teeth were cut longitudinally in the middle third of the crown with # 7020 double surface diamond disk (KG Sorensen, Barueri, SP-Br) coupled to a straight handpiece (Figure 1) to obtain specimens measuring 8 x 8 x 3.0 mm. The thickness was standardized using a pachymeter. After sectioning the teeth, the surfaces of all specimens with exposed dentin were sealed with colorless nail polish (Figure 2) to prevent dye penetration due to dentine permeability [4,12].

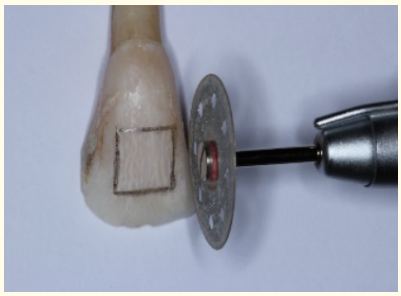

Figure 1

Figure 2

After isolation, the specimens were placed in saline solution for 72 hours. The initial color was analyzed using the CM-2600d/2500d spectrophotometer (Konica Minolta, Tokyo, Japan) and the CIEL*a*b* system. Three readings were performed using the parameters of the CIEL*a*b* system. From all 25 specimens, twelve specimens (n = 6) that presented mean lightness (L) of ± 10% were selected.

After being selected in accordance with the mean *L, the specimens were immersed in 200 ml of warm distilled water and 4g of yerba mate tea solution (Terra Mate, Paraná, Brazil) for 15 days (Figure 3). The solution was changed daily.

Figure 3

Finally, the specimens were washed in an ultrasonic bath for 5 minutes and submitted to new spectrophotometric color analysis.

The specimens were divided into two groups: Control Group (GC) and Experimental Group (GE). Those in the experimental group were bleached using the in-office bleaching technique and Whiteness HP Automix bleaching gel (FGM, Joinville, SC-Br) for three 50-minute sessions with a 5-day interval between each session, simulating 30-minute continuous daily intake of yerba mate (Figure 4). Prophylaxis was then performed using pumice stone, water and Robinson brush (American, Palhoça, Santa Catarina, Brazil). Those in the Control Group were only submitted to the bleaching procedure and were stored in saline solution during the intervals.

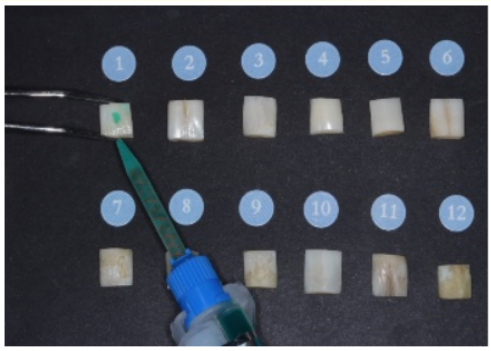

Figure 4

After bleaching, the specimens were submitted to a new color analysis. The color difference (ΔE) between the first and second readings was calculated according to the formula [13]: $\Delta E = [(L^*f - L^*i)^2 + (a^*f - a^*i)^2 + (b^*f - b^*i)^2] 1/2$; the initial reading values after the pigmentation protocol were L*i, a*i and b*i, and the reading values immediately after bleaching were L*f, a*f and b*f.

The delta values obtained were submitted to analysis of variance (ANOVA) and to the Tukey test for differentiation of means at a 5% global significance level.

Results

No statistical differences were observed between the control and experimental groups; the following p-values for each analysis were observed: △E = 0.72, △L=0.56, △a =0.074 and △b =0.75, respectively.

Treatment	Color Analysis	Average values
CG	△E	38.86 ± 11.88 A
	△L	38.56 ± 6.25 B
	△a	3.89 ± 1.45 C
	△b	-16.18 ± 5.83 D
EG	△E	40.8 ± 6.50 A
	△L	36.64 ± 4.75 B
	△a	2.15 ± 1.57 C
	△b	-17.36 ± 6.73 D

Table 1: *Mean values ± Standard deviation of color analysis after treatment (N = 6).*

Capital letters show that there was no statistical difference between the evaluations (p < 0,05).

Discussion

The results of the present study showed that the intake of yerba mate did not influence the final color after bleaching treatment and the null hypothesis was not rejected.

Studies for color evaluation can be performed visually or with spectrophotometers or colorimeters, thus eliminating subjective interpretations of choice and color perception, which are common in visual evaluations. Using the above-mentioned instruments, it

was possible to assign numerical values during the evaluation, facilitating the comparison and statistical analysis of the data. Koksal., *et al*. [14] correlated the values of L*, a* and b* separately to establish the greater or lesser variation in lightness (L*) of the object. The a* values correspond to the predominance of red (positive a* values) and green chroma (negative a* values), while the b* values refer to the predominance of yellow (positive b* values) and blue chroma (negative b* values). The values of ΔE, a combination of L*, a* and b*, represent the perceptibility of color differences and they are determined by the mathematical formula $\Delta E = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]$ 1/2, which can be converted into clinical significance.

Until recently, it was believed that eating habits, beverages, or products used for oral hygiene should be avoided so as not to cause staining during bleaching treatment. However, Rezende., *et al*. [1] and Matis., *et al*. [15] found that the intake of coffee during bleaching treatment did not influence treatment success. Therefore, it is important to test other types of food/drinks that might have the potential for staining.

The literature shows that, after the bleaching procedure, subclinical changes on the surface micromorphology of the dental tissues can occur, which would lead to greater sensitivity, increased porosity and surface roughness, and a decrease in microhardness, especially of enamel [16-20]. It has always been a consensus that these changes, particularly the increase in surface roughness, would facilitate staining and pigmentation if the patient used products or consumed foods that have a high potential for extrinsic pigmentation immediately after the bleaching procedure [16-20].

The product used to darken the specimens was yerba mate, infused mate leaves, which is mainly consumed by the population in southern Brazil as it is part of their culture and diet [7,8]. The study considered a 30-minute mean daily consumption, as there is no standard, but this is known to be the average time of consumption of the beverage in the southern region of Brazil.

The choice of bleaching product was due to its practicality, as it comes with a self-mixing tip without the need to exchange material. Furthermore, it can be kept for up to 50 minutes on the tooth surface because the pH remains neutral and stable throughout the session. It has been a concern of researchers that changes to tooth enamel caused by the bleaching agents [19,21] may adversely affect the effectiveness of treatment.

Other studies have reported that bleaching agents may cause changes to the enamel surface due to their acidity [22] and demineralization [23], which could favor the retention of stains. Thus, it is important to take into consideration the pH of the bleaching product. However, the product contains calcium, a substance that contributes to the maintenance of the integrity of the tooth surface, and it does not require the application of light.

When comparing the final and initial results from the CIEL*a*b* system, no color changes were observed. Therefore, it may be concluded that no significant darkening was observed in the specimens in the two groups. The analysis of $\triangle E$ ($p = 0.72$) showed that similarity was quite significant; greater differences were observed in L* between the groups ($p = 0.07$), but with no statistical difference. Although the values were not significant, the values indicated that the intensity of yellow decreased, becoming bluer when the b* parameter was analyzed. When analyzing a*, red was more prominent. This was probably because the teeth presented an excess of green as they were darkened in yerba mate. Bleaching decreased the intensity of green and the bleaching treatment was effective.

The 30-minute daily parameter was used to simulate the daily intake of yerba mate, since this is the average time people consume it. The determinant factor in color, discoloration and pigmentation of natural teeth was observed in the literature [9,14,24-26].

It is important to emphasize that pigmentation varies according to acquired biofilm, so prophylaxis was performed with pumice stone and water on a Robinson brush in the group that simulated the continuous intake of yerba mate.

The present *in vitro* study is an initial step for further research need to confirm the clinical findings of the present results.

Conclusion

The intake of yerba mate did not influence the final color obtained after bleaching treatment.

Conflict of Interest

The authors declares no conflict of interest.

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