Effect of gel replacement during in-office dental bleaching: a case report

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In-office dental bleaching allows the dentist to have greater control of the procedure and prevents patients from ingesting chemicals. To obtain optimum results, in-office bleaching usually requires a longer period of application as well as changes of the bleaching agent applied to the tooth surfaces at each appointment. The objective of this case report was to assess, by means of a split-mouth design in a single patient, the final tooth color and tooth sensitivity resulting from 2 different bleaching protocols: 1 application of 35% hydrogen peroxide for 45 minutes and 3 applications of 35% hydrogen peroxide for 15 minutes each. Neither the patient nor 5 individuals who were blinded to the techniques noted a difference in the final esthetic results of the 2 protocols immediately after the procedure. In addition, the patient reported that no tooth sensitivity was associated with either protocol. The results of dental bleaching on both sides were maintained after 15 days. The results shown in the present case report suggest that there may be no need to renew the gel during in-office dental bleaching.

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Patients frequently request dental bleaching because it is an effective, conservative means to improve the esthetics of a smile.[1,2] In addition, studies report that tooth bleaching improves patients' oral health–related quality of life.[3,4]

The effectiveness of tooth bleaching appears to be time and concentration dependent.[5] At-home tooth bleaching is usually recommended for several weeks, depending on the type of dental staining and the concentration of the bleaching gel, which may vary from 5% to 35% carbamide peroxide. This technique is the most common bleaching procedure.[6]

Despite the advantages of the at-home bleaching technique, some patients do not feel comfortable with wearing trays. In-office bleaching is an alternative technique. In-office bleaching with hydrogen peroxide (HP) was first introduced by Abbot in 1918.[7] In-office dental bleaching allows the dentist to have greater control of the procedure and prevents patients from ingesting chemicals.[8,9] During the in-office procedure, bleaching gel is placed on the enamel surfaces and can be illuminated with a light source.

In-office dental bleaching requires a higher concentration of hydrogen peroxide, usually 15%-38%.[6] Moreover, in-office bleaching usually requires a longer period of HP application, during which the bleaching agent on the tooth surfaces is changed to obtain optimum results.[10,11] During in-office bleaching, the HP is usually applied to the enamel surface and left undisturbed for 5-15 minutes; this procedure is repeated 3-5 times during each clinical appointment, depending on the brand of bleaching gel.[12]

The gel is renewed every 5-15 minutes due to the rapid degradation of hydrogen peroxide.[12] However, it has been reported that the mean concentration of active HP remaining in a low-concentration HP gel after 1 hour of contact with the teeth was 32.2%.[13] A similar degradation rate can be expected for a 35% HP gel.[12,14] Because bleaching gel retains substantial activity after 1 hour, a single, prolonged application might produce tooth lightening effects similar to repeated within-appointment applications.[12] This protocol would decrease the costs of in-office bleaching by reducing the amount of material used and shortening chair time.[12]

To date, few in vitro and in vivo studies have evaluated the effects of different protocols for gel renewal during in-office bleaching on the final results in terms of color change, final pH, and dental sensitivity. The purpose of this case report is to describe the final color and tooth sensitivity results obtained in a single patient treated with 2 different in-office bleaching protocols in a split-mouth design. Treatment consisted of 1 application of 35% HP for 45 minutes (1 × 45 minutes) on the patient's right side of the mouth and 3 applications of 35% HP for 15 minutes each (3 × 15 minutes) on the patient's left side.

Fig 1. The patient's smile before bleaching procedures reveals tooth discoloration.

Fig 2. A light-cured resin barrier is positioned to protect gingiva, and bleaching gel is applied.

Fig 3. Fifteen minutes after gel application, the edge of the pH measuring paper is positioned on the bleaching gel until the edge of the paper changes color.

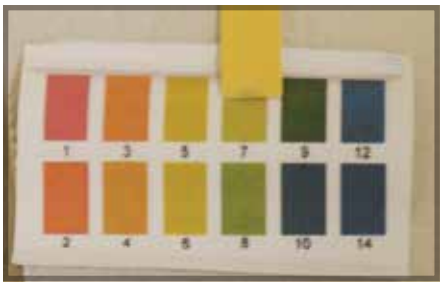

Fig 4. After the pH measuring paper has contacted the bleaching gel, the color on the edge of the paper is compared to the pH scale; the closest color indicates the approximate pH value of the gel.

Fig 5. On the patient's left side, the gel is renewed (pink gel). On the patient's right side, the gel is not renewed (transparent gel).

Fig 6. Thirty minutes after the first gel application, the pH was measured on both sides, indicating a pH of approximately 7.0.

Case report

The patient, a 36-year-old woman, was referred to the Postgraduate Clinic of the School of Dentistry, University of São Paulo, São Paulo, Brazil, for dental bleaching. The patient's dental history was obtained, and a clinical examination was performed. The patient, who showed satisfactory oral health and reported no tooth sensitivity, had received in-office dental bleaching 6 years previously. For the proposed bleaching treatment, the HP 35% bleaching gel on the left side of the patient's arch would be changed 3 times (every 15 minutes), in accordance with the manufacturer's instructions. On the right side of the arch, the same HP 35% gel would be kept in place for 45 minutes. The split-mouth approach was explained to the patient, and she provided her informed consent.

Prophylaxis of the teeth was performed with a prophylactic paste and a polishing brush. The patient's smile was photographed to obtain a record of the initial tooth color (Fig 1). The initial tooth color was also registered with a spectrophotometer (VITA Easyshade, VITA North America) that was positioned at the cervical, middle, and incisal thirds of the maxillary incisor and canine crowns.

A light-cured resin barrier was placed on the gingiva to protect the periodontal tissues (Fig 2). A disposable brush was used to apply 35% hydrogen peroxide gel (Whiteness HP 35, FGM Produtos Odontológicos) to the buccal surface of the maxillary and mandibular teeth from the right first premolar to the left first premolar, covering the entire tooth surface.

After 15 minutes, the pH of the peroxide gel was measured with pH measuring paper (J Prolab) on both sides of the mouth (Fig 3). The edge of the pH measuring paper was placed on the bleaching gel until color change was observed on the edge of the pH paper. The final color result obtained on the paper was compared to the closest color of the scale to estimate the pH of the gel (Fig 4).

After the pH was measured, the bleaching gel on the teeth on the left side of the arch was changed following the manufacturer's instructions (Fig 5). On the patient's right side, the same gel was kept on the teeth for the entire 45 minutes.

The pH of the peroxide gel was measured with pH measuring paper again, 30 minutes after initial placement of the bleaching gel, on both sides of the mouth (Fig 6). The gel on the left side of the dentition was renewed a second time (Fig 7). The pH of the gel was measured a final time 45 minutes after the initial application on the right side and 15 minutes after the third application on the left side (Fig 8).

The pH paper showed no variation in pH of the bleaching gel, from the first 15-minute test to immediately after the final bleaching session, in either protocol that was tested. The pH was found to be basic (approximately 7.0) at all times.

After treatment was completed, the patient reported that she was satisfied with the final color result and was not able to detect any difference between the right and left sides of the arch (Fig 9). Immediately and 3 days after the bleaching session, the patient was asked if she had experienced any tooth sensitivity. She reported no sensitivity in any of the bleached teeth.

Fig 7. On the patient's left side, the gel is renewed for the second time (pink gel). On the patient's right side, the gel is not renewed (transparent gel).

Fig 8. Forty-five minutes after the beginning of the first gel application, the pH is measured again on both sides, indicating a pH of approximately 7.0.

Fig 9. Immediately after the in-office bleaching treatment, there is no difference in color between the left and right sides.

The tooth shades were measured with the spectrophotometer at the end of the bleaching session and 15 days after treatment for comparison to the initial measurements. In all teeth, there was a change in color (Table). The result of dental bleaching of both sides was maintained after 15 days.

Five dentists and dental students who did not participate in the clinical procedure were asked to assess the change and report any difference observed in the final color on both sides. The 5 individuals, who were blinded to the treatments performed in each hemiarch, examined the patient in person. All of the observers reported that they found no clinically visible difference in the color of the 2 sides of the dentition.

Table. Maxillary tooth shades before and after bleaching.[a]

	Central incisor		Canine	
Tooth third	**Right**	**Left**	**Right**	**Left**
Initial shade				
Cervical	B3	A1	A2	A2
Middle	B1	B1	A1	B2
Incisal	B1	D2	D2	D2
Shade immediately after bleaching				
Cervical	A2	A1	B2	A2
Middle	B1	B1	A1	A1
Incisal	B1	B1	B1	B1
Shade 15 days after bleaching				
Cervical	A2	A1	A2	B2
Middle	B1	B1	A1	A1
Incisal	B1	A1	A1	A1

[a]Measured with a digital spectrophotometer (VITA Easyshade). Teeth were bleached with 35% hydrogen peroxide: right teeth, 1 × 45-minute application; left teeth, 3 × 15-minute applications.

Discussion

In-office dental bleaching usually requires a long period of application at each appointment, during which the bleaching agent is reapplied to the tooth surfaces multiple times.[10,11] The present case report described the results of 2 different in-office dental bleaching protocols used in the same patient (split-mouth dental bleaching). No difference was detected in the final tooth color obtained via the 2 protocols. In addition, the patient reported no tooth sensitivity on either of the bleached sides.

Most manufacturers of these types of products recommend that bleaching gel be replaced every 15 minutes.[15] Furthermore, according to manufacturers, the half-life of the bleaching product is usually 10-15 minutes, which means that the bleaching agent has to be replaced after this time frame. However, the literature shows conflicting findings on this topic, and few investigations have studied the ideal protocol for in-office dental bleaching. There is no strong evidence to recommend the renewal of bleaching gel every 15 minutes.

To the best of the authors' knowledge, 2 clinical trials have tested different in-office bleaching protocols to investigate the need to replace the bleaching gel.[12,16] Reis et al tested the same protocols adopted in the present clinical case: 3 × 15-minute applications and a 1 × 45-minute application of 35% HP gel.[12] Their study involved 30 patients (n = 15 per protocol) and did not have a split-mouth design.[12] Contrary to the results of the present single clinical case report, Reis et al concluded that a 35% hydrogen peroxide gel for in-office bleaching should be applied in 3 × 15-minute applications because a 1 × 45-minute application reduced the bleaching speed and slightly increased the intensity of tooth sensitivity.[12]

Vildósola et al applied a 6% HP gel with hybrid LED/laser activation in 30 patients in a split-mouth design.[16] In all patients, half of their arch was treated with a conventional 3 × 12-minute protocol, and the other half was submitted to a 1 × 36-minute application of bleach. These applications were equally effective, and no differences in sensitivity were reported by the patients. Despite the difference in gel concentration and duration of the protocols adopted by Vildósola et al, their study presented the same results as those found in the present case report.[16] Further clinical trials should be performed with the objective of achieving an evidenced-based protocol.

Other studies regarding this topic were performed in vitro.[17-20] All these in vitro studies concluded that renewing the gel during in-office dental bleaching is unnecessary. Caneppele et al concluded that changing the bleaching gel 3 × 10 minutes per session did not affect the efficacy of the treatment in comparison

with 1 × 30-minute and 1 × 40-minute applications.[17] In their in vitro study, Al-Harbi et al also verified that no difference in the bleaching effect could be observed after applying the product in 2 × 30-minute or 4 × 15-minute sessions.[18]

Kwon et al investigated the final bleaching result and amount of HP penetration into the pulp chamber after 2 protocols of in-office dental bleaching: 3 × 20 minutes (n = 40) and 1 × 60 minutes (n = 40).[19] In the 1 × 60-minute group, the authors covered the teeth with a linear low-density polyethylene wrap to prevent dehydration of the gel. There was no difference in the final color for the 2 protocols; however, there was significantly greater hydrogen peroxide penetration into the pulp for the conventional bleaching group (3 × 20 minutes). Color change measures did not appear to be correlated with hydrogen peroxide penetration. Marson et al also reported no difference in lightness change after bleaching when comparing the techniques of a single 1 × 45-minute and 3 × 15-minute applications.[20]

In the present case study, the pH of the bleaching gel in both protocols was measured 3 times: 15, 30, and 45 minutes after the start of treatment. The decomposition of hydrogen peroxide is accelerated by alkalinity.[17] For this reason, some dental bleaching products come in 2 bottles, 1 containing a stable acidic HP solution and the other an alkaline catalyst.[17] When the solutions are mixed, the pH becomes neutral, initiating both activity and degradation of the hydrogen peroxide over time. As the HP degrades, it becomes acidic, decreasing the effectiveness of its action and possibly causing damage to tooth structure.[17]

The potential for structural damage of the teeth would be a justification for changing the HP gel during in-office bleaching.[17] However, decomposition of HP requires a certain period of time if no activator (such as heat) is used.[17] Caneppele et al verified that the pH of 35% HP gel was 6.54 at baseline and 6.30 after 40 minutes; that is, pH did not change substantially after 40 minutes.[17] After 40 minutes, a small, nonsignificant decrease in pH was observed. However, the pH remained within acceptable levels; it was not acidic enough to promote enamel demineralization, and the acidity reduced degradation of the product.[17] In the present case report, the same results were observed for pH measurements. The pH of the bleaching gel showed basic values for both protocols at the beginning of and after bleaching.

Marson et al found only a minor decrease, from 34% to 29%, in the concentration of hydrogen peroxide after 40 minutes.[20] This finding supports the idea that there is no need to replace the gel during a single, in-office bleaching treatment. Caneppele et al reported that only a small, nonsignificant decrease in HP concentration was detected on the tooth surface 40 minutes after gel application, indicating that a small amount of peroxide had degraded.[17] Their result corroborated the findings of other studies in the literature, which determined in vitro that 91%-93% of active HP was still available for bleaching procedures 45 minutes after mixing of 35%-38% HP gels.[12,20] Thus, the rapid degradation of hydrogen peroxide is not a valid rationale for replacing dental bleaching gel every 15 minutes.[17]

Conclusion

No difference regarding the final esthetic results was noted after the use of 2 different bleaching protocols in a split-mouth study of a single patient. In addition, the patient reported no tooth sensitivity associated with either protocol. The results in the present case report suggest that there is no need to renew the gel during in-office dental bleaching. Further studies should be conducted with the objective of determining an evidence-based protocol.

Author information

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