

Tooth Whitening of Tetracycline-Stained Teeth

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ABSTRACT

Tooth discoloration of intrinsic etiology such as from tetracycline ingestion can be a major esthetic problem. This clinical report describes the use of an extended whitening treatment of second-degree tetracycline stained teeth. The suggested combination of in-office and home whitening provided a fast whitening result, proper monitoring of the progress of whitening throughout the extended period, and continuous motivation for the patient to complete the whitening treatment.

Keywords: Esthetics, Tetracycline-stained teeth, Tooth whitening, Mercury release.

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INTRODUCTION

Tooth discoloration of intrinsic etiology, such as from tetracycline ingestion can be a major esthetic problem that if untreated, produces social and psychological difficulties, especially among teenagers.¹ The intensity and color distribution can vary depending on the type of tetracycline used, as well as the amount and duration of drug administration. Tetracycline antibiotics, when administered during tooth development, are deposited in the forming dentin, exhibiting a yellow to brown or a blue to grey discoloration through the overlying enamel.²

Restorative treatment options ranging from direct resin veneers to full veneer crowns are available to mask the discoloration. However, such treatments require subjecting the patient to extensive, time-consuming and costly dental procedures, which may also have to be replaced periodically.

A less invasive protocol by whitening discolored teeth in the office with 30% hydrogen peroxide warmed by a hand held heating source has been reported by Cohen and Parkins in 1970, with significant esthetic improvement.³

Since, the introduction of nightguard vital bleaching by Haywood and Heymann⁴ in 1989, home whitening with the use of a custom fabricated tray and 10% carbamide peroxide has become one of the most conservative and safest method to whiten discolored teeth. Furthermore, the use of extended periods of home whitening has shown to be effective in producing various degrees of lightening in tetracycline-stained teeth.⁵⁻⁹ Generally, 6 months of treatment is required for satisfactory results in cases with yellow-brown or grey horizontal banding, with more than 55% of whitening occurring within the first 1 month.⁸ A 7 years 6 months

follow-up study demonstrated no detrimental effects on the tooth pulp or patient with this extended whitening protocol.⁹

The combination of in-office and at-home whitening has demonstrated easier and faster means of providing patients with lighter teeth.¹⁰⁻¹³ Even in tetracycline-stained teeth a combination approach over a 2 months period satisfied the patient's desire for improved esthetics.¹⁴

This clinical report describes the treatment of tetracycline-stained teeth, emphasizing the benefits of a combination approach of extended in-office and home whitening.

CLINICAL REPORT

A 32-year-old female with moderate tetracycline-stained teeth expressed a desire to improve her tooth color by means of conservative esthetic therapy.

A clinical and radiographic examination was performed to rule out any preexisting pathosis other than tooth discoloration. The medical and dental history revealed ingestion of tetracycline during childhood. The pre-treatment photographs showed generalized brown discoloration with slight banding localized in the middle area (Fig. 1). Such condition can be classified as second degree in the Jordan and Boksman's classification of tetracycline stains (Table 1).¹⁵ Previous amalgam fillings were noted on the buccal pits of the lower first molars.

The patient was informed about all treatment options ranging from conservative tooth whitening to more aggressive treatments including porcelain laminate veneers and full coverage restorations. In case of whitening an extended protocol was suggested with recommendations to replace the two amalgam fillings due to potential of mercury release associated with prolonged exposure to whitening agents.^{16,17}

The patient decided on a combination of in-office and home whitening for 16 weeks with replacement of the amalgam fillings prior to whitening, and signed the informed consent.

Table 1: Tetracycline-stained teeth, classification by Jordan and Boksman

Score	Clinical presentation
0	No tetracycline staining evident
1	Uniform light yellow, brown, or gray stain confined to incisal three quarters of the crown
2	Deep yellow, brown or gray stain, without banding
3	Dark gray or blue stain with marked banding
4	More severe or extreme staining



Fig. 1: Pretreatment photograph showing generalized brown discoloration with slight banding localized in the middle area



Fig. 2: Shade analysis of teeth before (left) and after whitening (right) in the cervical, middle and incisal area, as measured with a spectrophotometer (Spectroshade, MHT Niederhasli, Switzerland)

The baseline shade of the anterior teeth was recorded with a spectrophotometer (Spectroshade, MHT Niederhasli, Switzerland) to obtain objective data and a baseline smile analysis (Fig. 2).

Alginate impressions of both arches were taken and poured with dental stone. The casts were trimmed and custom fabricated trays were made with a 0.035 inch thick, 5 × 5 inch soft tray material in a heat/vacuum tray-forming machine.

Trays were trimmed in a scalloped pattern to properly fit the model and the patient instructed on the proper use of the upper tray and home whitening kit (Opalescence PF 10%, Ultradent Products, Inc., Utah, USA) (Fig. 3). The lower tray was kept in the office until treatment started on the lower teeth.

During the 8 weeks, the patient was recalled once every week for in-office whitening and proper monitoring of the progress of at home whitening. The patient received a total of eight in-office sessions on the upper arch.

At each session teeth were pumiced to remove all superficial debris. A disposable cheek retractor (Optragate, Ivoclar Vivadent, Liechtenstein) was placed and a gingival resin protector (OpalDam Green, Ultradent Products, Inc., Utah, USA) applied to cover approximately 0.5 mm of the tooth and 2 to 3 mm of the gingiva. A 40% hydrogen peroxide gel (Opalescence Boost PF, Ultradent Products, Inc., Utah, USA) was homogenously applied on the teeth and sealed with a linear low-density polyethylene wrap (Saran Wrap, SC Johnson & Son, Inc. WI, USA) to keep the active agents concentrated near the tooth surface and prevent dehydration of the gel (Fig. 4).¹⁸ The power whitening material, the wrap and the resin barrier was removed after 40 minutes and teeth rinsed with water. The session was completed by applying a desensitizing gel—0.11% neutral fluoride and 3% potassium nitrate (UltraEZ, Ultradent Products, Inc., Utah, USA), for 10 minutes.

In order to minimize sensitivity and maximize patient satisfaction, the upper and lower arch were treated separately



Fig. 3: Delivery of upper tray, home whitening gel and desensitizing gel (Opalescence PF 10% and UltraEZ, Ultradent Products, Inc, Utah, USA)



Fig. 4: A 40% hydrogen peroxide gel (Opalescence Boost PF, Ultradent Products, Inc, Utah, USA) was homogenously applied on the teeth and sealed with a linear low-density polyethylene (LLDPE) wrap

and photographs taken to record the difference (Fig. 5). The amalgam fillings on the lower first molars were replaced with composite resin fillings of a lighter shade. The patient received the lower tray and additional syringes to start whitening of the lower teeth. Office whitening on the lower arch was performed once a week for 8 weeks.

After a combination of in-office and home whitening for 16 weeks, the whitening was completed and final photographs were taken (Fig. 6). Postwhitening shade measurements were taken to assess the overall color change by means of vertical split-image software (Ver. 2.41, MHT, Niederhasli, Switzerland) (Fig. 7).



Fig. 5: Whitening of the upper arch for 8 weeks produced marked difference between the upper and lower teeth

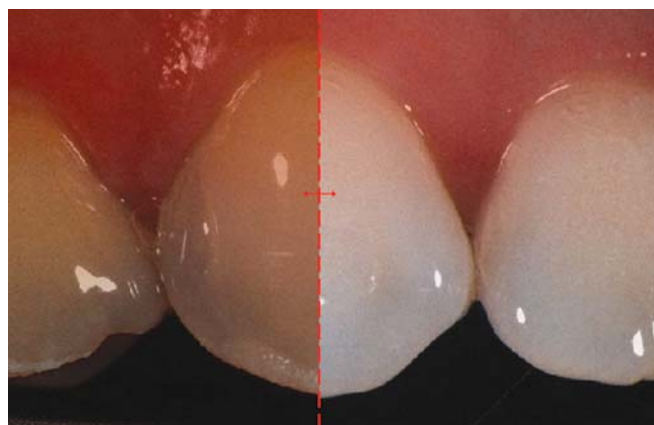


Fig. 7: Vertical split-image software (Ver. 2.41, MHT, Niederhasli, Switzerland) to assess the overall color change after whitening



Fig. 6: Post-treatment photograph, after a combination of in-office and home whitening for 16 weeks

she experienced some sensitivity throughout the treatment, it was not enough to discontinue treatment or even use the desensitizing gel provided.

DISCUSSION AND CONCLUSION

This clinical report described the use of an extended whitening treatment of second-degree tetracycline-stained teeth. Since, this is an extended protocol for a long duration, it is prudent to suggest replacing the two amalgam fillings due to potential of mercury release associated with prolonged exposure to whitening agents. Patients with extensive amalgam posterior restorations may have to be consented after detailed explanation of the protocol.

Separate whitening of upper and lower arches is also a prudent protocol since the insertion of two trays in the mouth simultaneously may interfere with occlusion and introduce patient discomfort. It also serves as a basis of comparison. Unless cases are documented properly, patient often times forget their initial discolored condition. With the contrast of the untreated arch, this will eliminate any disagreement. Although the split-image software can serve the same contrasting purpose, not all dentists have access to additional computer software.

The combination of in-office and home whitening provided a faster whitening result, proper monitoring of the progress of whitening throughout the extended period and

The Commission International de l'Eclairage color system was used to determine the overall color difference (ΔE) as determined by the following equation: $\Delta E = (\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2})^{1/2}$

Table 2 summarizes the overall color change and the color parameters (L^* , a^* , b^*) of the six upper anterior teeth. Considerable increase in lightness and a marked decrease in chroma in the yellow-blue axis were noted in all teeth. Noteworthy was the tremendous overall color change in the canines (ΔE : 23.14 and 24.58).

The patient was satisfied with the esthetic result and agreed to regularly perform touch-ups, if needed. Although

Table 2: Overall tooth color change (ΔE) and color parameters (L^* , a^* , b^*) before and after tooth whitening

	Right canine		Right lateral incisor		Right central incisor		Left central incisor		Left lateral incisor		Left canine	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
L^*	58.64	75.54	64.67	75.22	68.12	78.03	67.9	77.62	64.53	76.06	60.68	74.6
a^*	8.31	2.53	5.37	1.81	3.25	1.09	3.3	1.51	5.65	1.67	7.74	2.4
b^*	24.24	7.35	25.71	10.47	19.88	8.22	20.35	8.85	25.96	9.63	24.92	7.22
ΔE	24.58		18.87		15.45		15.16		20.39		23.14	

continuous motivation for the patient to complete the whitening.

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