Evaluation of the Effect of Laser Tooth Whitening

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> Purpose: This study aimed to determine whether gender, age, and initial tooth hue impacted the effect of laser tooth whitening. Materials and Methods: Ninety-one subjects were enrolled in a laser tooth whitening study at Kaohsiung Medical University. Sensitivity was evaluated by asking the patients about any tooth sensitivity they experienced after the whitening procedures were performed. The LaserSmile tooth whitener, containing 35% hydrogen peroxide, was applied to the tooth surfaces of both arches from the central incisor to the second premolar, and the LaserSmile Twilite diode laser was applied to the same maxillary and mandibular teeth. After removal of the whitening gel, shade matching was immediately performed with the ShadeEye NCC Dental Chroma Meter. Patients were classified into the following groups: tetracycline stain, gender, age, and initial tooth hue. Only 5 of the 91 individuals had tetracycline staining. *Results:* The initial tooth shade and the amount of shade change showed no significant differences between female and male patients, but a significant difference was found between hue and age group. Conclusions: Teeth with hue A showed greater shade improvement than teeth with hue C and hue D. Whitening response was better in younger individuals, and gender was not a factor that affected the whitening response. Sensitivity is common during the whitening procedure but can be tolerated by the patients. Int J Prosthodont 2008;21:415-418.

reatment options for tooth whitening include in-office procedures and take-home systems.

Many people consider take-home systems too time consuming; therefore, clinicians have found faster and easier ways to whiten patient's teeth. In-office laser tooth whitening has become increasingly popular over the past several decades, and is known to be an effective way of whitening discolored teeth. As always, the patient and clinician should communicate before the procedure so that treatment expectations can be discussed.

A large number of clinical studies have documented the effectiveness of laser tooth whitening in changing tooth color through whitening and lightening. However, bleaching efficacy is not predictable, and it has become apparent that some factors may affect the amount of shade improvement after tooth whitening. This study aimed to determine whether gender, age, and initial tooth hue impacted the effect of tooth whitening.

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Fig 1 (*left*) Sample case prior to tooth whitening.

Fig 2 (*right*) Sample case after tooth whitening.

Materials and Methods

Ninety-one subjects were enrolled in a laser whitening study at Kaohsiung Medical University.

The cohort study consisted of 30 men and 61 women aged 19 to 53 years old, with a mean age of 25.9 years. Patients that had caries were treated prior to tooth whitening. Explanations about the whitening procedure, indications, and risks were given. Patients were prescribed 250 mg of mefanamic acid (Ponstan, Pfizer) to prevent sensitivity. Each patient was asked about any tooth sensitivity they experienced after the whitening procedures were performed. The degrees of sensitivity were ranked as follows: 1 = none; 2 = mild; 3 = moderate; 4 = considerable; and 5 = severe. During the whitening procedure, all tooth surfaces were cleaned with a rubber cup and pumice powder to eliminate stains and remove plague. Cheek retractors were placed to retract the skin and lips from the treatment areas (Fig 1). Vaseline was applied to the patient's lips and oral mucosa. To protect the maxillary and mandibular gingiva, as well as exposed dentin and cementum, a light-cured resin liquid dam was applied over the entire gingiva according to the manufacturer's instructions. The patient and the clinician wore protective eyeglasses during the procedure.

The LaserSmile tooth whitener (Biolase), containing 35% hydrogen peroxide, was applied to the tooth surfaces of both arches from the central incisor to the second premolar. The LaserSmile Twilite diode laser (Biolase) was applied to the maxillary and mandibular teeth for one session. Each session was broken down into 3 applications of the LaserSmile tooth whitener, with the duration of the first application lasting 7 minutes. This included application to 4 quadrants of the mouth (15 seconds each). The gel was rinsed and reapplied between each application for each cycle. The second and third applications lasted 4 minutes each. After finishing, the whitening gel was removed with high power suction and rinsed with water (Fig 2), and shade matching was immediately carried out with ShadeEye NCC Dental Chroma Meter (Shofu). Shade was registered at 1 spot of the vestibular surface. The measurement area was 2.0 to 4.0 mm above the gingiva and at the center of the cervical area. There should be no discoloration or demineralized areas present on

the selected measurement area and the tooth surface must be slightly moist.

Patients were classified into the following groups: tetracycline stain, gender, age, and initial tooth hue. Only 5 of the 91 patients had tetracycline staining.

Results

The average initial shade was a mean of 14.81 ± 2.10 for the tetracycline group and 10.19 ± 3.69 shades for the non-tetracycline group (*P* < .0001).

The non-tetracycline group showed a larger amount of shade change than that of the tetracycline group. The average shade change for the tetracycline group was a mean of 4.08 \pm 2.16; for the non-tetracycline group, the average shade change was 5.67 \pm 3.01 (*P*<.0001) (Table 1).

The average initial shade for the \geq 30 years old group was a mean of 11.53 \pm 3.59; for the < 30 years old group, the average initial shade was 9.98 \pm 3.66 (P < .0001). The < 30 years old group showed a larger amount of shade change than that of the \geq 30 years old group. The average shade change for the \geq 30 years old group was a mean of 4.62 ± 2.42 ; for the < 30 years old group, the average shade change was 5.83 \pm 3.06 (P < .0001) (Table 2). The average initial shade was a mean of 10.08 \pm 3.71 for the female group and 10.40 \pm 3.64 for the male group (P=.1001). The average shade change for the female group was a mean of 5.69 ± 3.00 ; for the male group, the average shade change was 5.62 \pm 3.02 (P = .6667) (Table 3). We found no significant shade change difference and no significant initial shade difference between female and male patients.

The average initial shade was 10.21 ± 3.42 for the hue A group, 12.49 ± 3.92 for the hue C group, and 8.16 \pm 2.77 for the hue D group (P < .0001). The average shade change was a mean of 6.48 ± 3.05 for the hue A group, 5.64 ± 2.80 for the hue C group, and 3.86 ± 2.18 for the hue D group (P < .0001) (Table 4).

Three-way analysis of variance was used to compare gender, age, and hue, and repeated measurements were also factored in (Table 5). The amount of shade change showed no significant difference between men and women (P=.9703); however, a significant difference was found for hue (P<.0001) and age (P=.0460).

Table 1Initial Tooth Shade Before Bleaching and ShadeImprovement After Bleaching (Mean \pm SD) in theTetracycline Group and Non-tetracycline Group

Staining	No. of subjects	Initial tooth shade	Shade change
Tetracycline	5	14.81 ± 2.10	4.08 ± 2.16
Non-tetracycline	86	10.19 ± 3.69	5.67 ± 3.01
<i>P</i> *		<.0001	<.0001

*t test.

Table 3 Initial Tooth Shade Before Bleaching and Shade Improvement After Bleaching (Mean \pm SD) of Female and Male Subjects

Gender	No. of subjects	Initial tooth shade	Shade change
Male	29	10.40 ± 3.64	5.62 ± 3.02
Female	57	10.08 ± 3.71	5.69 ± 3.00
<i>P</i> *		.1001	.6667

*t test.

Seven patients reported no sensitivity, 36 patients reported mild sensitivity, 35 patients reported moderate sensitivity, 10 patients reported considerable sensitivity, and 3 patients reported severe sensitivity during the active bleaching period.

Sixty-eight of 86 patients who experienced sensitivity reported that the sensitivity disappeared before the bleaching process ended. The other 18 patients experienced sensitivity for no longer than 2 days after the whitening procedure was performed. According to the sensitivity evaluation, sensitivity is very common during the whitening procedure, but can be tolerated by patients.

Discussion

Patient expectations of the final results of bleaching procedures can vary greatly. Some patients may only wish to have lighter teeth but do not have a specific shade in mind. Other patients may demand, for example, a final shade no darker than Vita B1 (VITA Shade Guide, VITA Zahnfabrik). This group of patients may be difficult or impossible to satisfy.

Using a laser for bleaching usually produces "instant" results; that is, at the end of the treatment, the teeth are their lightest. The use of a nonlaser light source such as a "zoom" light will also produce instant results. (Home bleaching, of course, requires several applications, and the results are more gradual.)

If the patient is not satisfied with the color after the laser bleaching is completed, home bleaching should be used. However, the patient should be informed that further lightening may not occur. **Table 2**Initial Tooth Shade Before Bleaching and ShadeImprovement After Bleaching (Mean \pm SD) in the < 30</td>Years Old Group and \geq 30 Years Old Group

Age (y)	No. of subjects	Initial tooth shade	Shade change
≥ 30	13	11.53 ± 3.59	4.62 ± 2.42
< 30	73	9.98 ± 3.66	5.83 ± 3.06
P*		<.0001	<.0001

*t test.

Table 4	Initial Tooth Shade Before Bleaching and Shade
Improvem	ent After Bleaching (Mean \pm SD) of Hue A, Hue
C, and Hu	e D Groups

Hue	No. of teeth	Initial tooth shade	Shade change
A	896	10.21 ± 3.42	6.48 ± 3.05
С	344	12.49 ± 3.92	5.64 ± 2.80
D	400	8.16 ± 2.77	3.86 ± 2.18
P*		<.0001	<.0001

*One-way analysis of variance.

Table 5	Results of th	e Three-Way	v Analvsis o	f Variance
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Source	DF	F ratio	P*
Gender	1	0.0014	.9703
Hue	2	95.3967	<.0001
Age	1	4.0991	.0460

*Prob > F.

Shigemi et al¹ stated that the strong correlation found between ΔE and b* values demonstrates that bleaching works effectively for teeth with a yellow hue. When comparing shade tabs to the b* values,² shade tabs of hue A seem to have a higher b* value than hue C and hue D. The present study demonstrated that the hue A group has greater shade improvement than the hue C and hue D groups.

No teeth with hue B were detected in this study, which is similar to the findings of Yamamoto,³ who stated that hue B teeth are rarely found in the Japanese population. The same situation seems to exist in Taiwan. Gerlach and Zhou⁴ concluded that the whitening response is better in younger individuals and that there is no significant difference between male and female patients. This study confirms that conclusion. Haywood⁵ also reported that it is more difficult to achieve good whitening results for tetracycline stained teeth, and this study had a similar outcome.

Conclusions

From this clinical study, the following conclusions were drawn:

- 1. Hue A teeth showed greater shade improvement than those of hue C and hue D teeth.
- 2. The whitening response is better in younger individuals.
- 3. Gender is not a factor that affects whitening response.
- Sensitivity is common during the whitening procedure but can be tolerated by patients.

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Literature Abstract

Physical activity and quality of life in head and neck cancer survivors

The purpose of this cross-sectional observational study was to investigate the frequency of exercise among head and neck cancer (oral cavity, pharynx, larynx, nasal cavity, or salivary gland) patients and its implications on quality of life (QoL), fatigue, and depression. Fifty-nine patients (49 men and 10 women) with a history of head and neck cancer were recruited at an academic out-patient clinic to participate in the self-administered survey. The mean number of months it had been since diagnosis was 18.6 ± 50.9, with 51% of patients less than 6 months from diagnosis. Self-reported physical activity was measured using the Godin Leisure-Time Exercise Questionnaire. This questionnaire asks the subject to report duration and frequency of light, moderate, and vigorous activity during the past week as well as the average physical activity per week over a typical month in the year prior to cancer diagnosis. QoL was determined using the FACT-H&N, which is head and neck cancer specific, and the more general FACT-G. Fatigue level was obtained from a portion of the FACT-H&N and depression was measured using the Center for Epidemiological Studies-Depression (CES-D) scale. Information on demographics and medical history was recorded through survey and chart review. More than half of patients reported light to no physical activity before diagnosis and 10 patients (17%) reported exercising vigorously each week. After diagnosis, 44% of patients reported exercising less than they did pre-diagnosis, 49% did not change their exercising habits, and 7% increased activity level post-diagnosis. Zero order correlations showed that patients who exercised more frequently had better QoL, showing a "medium" effect size for the FACT-G, FACT-H&N, and functional well-being (FACT-G r = 0.33, FACT-H&N r = 0.33, FWB r = 0.38). Correlations were adjusted for age, alcohol use, and comorbidity in patients; high QoL continued to be associated with more frequent exercise (FACT H&N r = 0.25, FACT-G r = 0.26). Before and after adjustment, fatigue level was negatively associated with amount of exercise (r = -0.33, r = -0.27). The results of this clinical study suggest that higher numbers of minutes of weekly physical activity are associated with better QoL and lower levels of fatigue in survivors of head and neck cancer. No association was found between depression and activity level.

Rogers LQ, Courneya KS, Robbins KT, et al. Support Care Cancer 2006;14:1012-1019. References: 31. Reprints: Dr Laura Q. Rogers, Department of Medicine, SIU School of Medicine, P.O. Box 19636 Springfield, IL 62794-9636, USA; Email: Irogers@siumed.edu — Alvin G. Wee, UNMC Dept Otolaryngology, Omaha, NE

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