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Vital Bleaching of Tetracycline-Stained Teeth by Using KTP Laser: A Case Report

Jun-Ichiro Kinoshita[a]
Hamid Jafarzadeh[b]
Maryam Forghani[b]

ABSTRACT

Bleaching of discolored teeth is one of the most important topics in aesthetic dentistry. A great challenge in this area is obtaining good results in tetracycline-stained teeth. The wavelength and features of KTP laser, which is a type of Nd:YAG laser, seem to be appropriate for bleaching of these teeth. This case report underlines the importance of knowledge about the photochemical bleaching by using the KTP laser and its side effects on soft tissues. (Eur J Dent 2009;3:229-232)

Key words: KTP laser; Bleaching; Tetracycline.

INTRODUCTION

The general population relates new dentistry to improved aesthetics and social success. Tooth bleaching is the most commonly requested elective cosmetic service in most dental offices.[1]

Tetracycline-stained teeth are one of the most difficult cases for achieving acceptable results of bleaching. Tetracycline, when consumed during the developmental period of the teeth, will result in a characteristic blue-gray or yellow-brown opalescent discoloration of the dentin. This is thought to be a photo-initiated reaction, explaining why the incisors tend to be more affected than the molars.[1]

Tooth shade depends on the type of tetracycline, dosage, duration of intake, and patient's age at the time of administration. Discoloration is usually bilateral, affecting multiple teeth in both arches. Deposition of the tetracycline may be continuous or laid down in stripes depending on whether the ingestion was continuous or interrupted.[2]

Two approaches have been used to treat tetracycline discoloration: (i) bleaching the external enamel surface[3-5] and (ii) intracoronal bleaching following intentional root canal therapy.[6-8]

Some types of lasers can be used for extracoronal bleaching. These include the argon laser, carbon dioxide (CO_2) laser, and diode laser.[2] Recently, a new type of laser called KTP laser is getting more and more popular in Europe and Japan. This laser has been used in plastic

[a] Department of Clinical Cariology and Endodontology, Showa University School of Dentistry, Tokyo, Japan.
[b] Department of Endodontics, Faculty of Dentistry and Dental Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.

Corresponding author: Dr. Hamid Jafarzadeh
Faculty of Dentistry and Dental Research Center
Vakilabad Blvd, P.O. Box: 91735-984, Mashhad, Iran.
Phone: +98 511 8829501
Fax: +98 511 7626058
E-mail: hamid_j365@yahoo.com
JafarzadehBH@mums.ac.ir

surgery (e.g., removing tattoo, hemangioma, and melanosis) with acceptable results.[9-11]

The present report describes the vital bleaching of tetracycline-stained teeth by using KTP laser.

CASE REPORT

A 32-year-old male Japanese patient with the chief complaint of teeth discoloration was referred to the Showa University School of Dentistry, Tokyo, Japan. In clinical examination, yellowish colors of the cervical aspect of all teeth in addition to dark calculus were observed (Figure 1). Informed consent was obtained after the explanation of what was expected by the bleaching treatment by using KTP laser.

In the beginning of the treatment, by using VITAPAN classical shades guide (Vita Zahnfabric, Bad Säckingen, Germany), original color shade was recorded as C4 to be used as a baseline, and then, the crown surface was polished for removing the organic substances (Figure 2).

35% hydrogen peroxide gel (Smartbleach, SBI nv., Herzele, Belgium), with pH around 10, was prepared after mixing with buffering powder just before the treatment. Hydrogen peroxide can easily damage soft tissues, so light-curing soft composite resin (Smartblock, SBI nv., Herzele, Belgium) was placed at the marginal borders as a gum protector (Figure 3). Bleaching gel was placed on the tooth surface, and KTP light (SmartLite, Deka, Frenze, Italy) by 532 nm wavelength and 1 watt power was irradiated for 30 seconds for each tooth. The distance between the instrument tip and tooth surface was kept at 10 mm. Circular motion was employed to prevent overheating.

After finishing of the irradiation, fluoride gel was applied on the treated surface of the teeth; and then, in order to prevent post-treatment hypersensitivity, KTP laser by 1 watt power was irradiated again for 15 seconds. The first session stopped here; however, sessions can be repeated up to 3 times in each appointment, if necessary.

After only one session of KTP bleaching, almost all of treated teeth had B2 shade in the cervical area (Figures 4-6).

The peroxide burn of the gingiva around lower left premolars showed a side effect of using hydrogen peroxide, possibly because composite block was insufficient. This was possibly due to the incomplete drying of the surface before blocking which resulted in gingival inflammation. The patient complained of pain a little just after the session but not insisted on stopping the treatment. Vitamin E ointment (Maruha, Tokyo, Japan) was applied to the marginal gingiva for help to healing. After 30 minutes, the pain was disappeared and the color of the gingiva returned to the original pink appearance.

DISCUSSION

KTP (Karium-Titanium-Phosphoric acid), which is a type of Nd:YAG laser, seems to be appropriate for bleaching of tetracycline-stained teeth. When Nd:YAG laser beam (wavelength: 1064 nm) goes through the solid medium of KTP crystal, its wavelength decreases into 532 nm, just half of the original wavelength. This means KTP has very similar characteristics to Nd:YAG, plus that a few unique characteristics can be added.[12]

Green visible light of KTP is absorbed well in hemoglobin and melanin[13-15] but not in hydroxyapatite or water.[16] KTP tends to penetrate into dentin with less damage. This laser does not increase temperature much. Its photons have high energy that facilitate the chemical and photodynamic reactions without damage to both hard and pulp tissues.[17-21] It has been shown that KTP laser is capable of producing significantly more effect than LED or diode laser.[17]

Because of small molecular weight of hydrogen peroxide, it can penetrate into organic substances among hydroxy-apatite crystals. By KTP laser's efficient acceleration, hydrogen peroxide cuts the chain and open the carbon rings, resulting in brightening the color of collagen.[12, 22, 23]

Among many kinds of lasers, KTP is cooler in temperature and stronger in photon energy, which means KTP is suitable for vital teeth bleaching without damage to pulp tissue.[18-21] When an appropriate outer energy is applied, the number of radical oxide in the gel grows rapidly and they penetrate deeper into dentin. Then strong energy of photons from KTP runs after the radical oxide into very deeper area, due to the fact that KTP penetrate dentin easily to accelerate the whole chemical reactions.

Painless irradiating procedure enables operator to do sufficient irradiation on vital teeth. In this case, after 30 seconds of irradiation, fluoride gel was applied on the treated tooth

surface. This procedure prevents hypersensitivity that contributes to whitening treatment by stuffing open dentinal tubules at cervical area.

If the soft tissues near the cervical area be exposed to 35% hydrogen peroxide, the gingival surface would be burned and the patient would report some pain; however, the symptoms are not severe, and will return to normal status within 30 minutes after the application of vitamin E ointment. This accident can be avoided by appropriate guarding by soft composite resin or ointment placed on the margins on the tooth surface.

CONCLUSIONS

Vital bleaching by using KTP laser could be achieved in shorter time than simple chemical

Figure 1. Before treatment, calculus and discoloration were observed. Shade-taking resulted in C4.

Figure 2. After polishing: Diagnosed was tetracycline-staining by inquiries about medical history.

Figure 3. After 30 seconds' irradiation for each tooth: Half of the hydrogen peroxide gel was vaporized off. Gum protector (light-cured soft composite resin) is recognized.

Figure 4. After wiping off the gel.

Figure 5. Gum protector was easily removed with exploring needle. Shade evaluation showed 1 session dramatically changed teeth color from C4 to B2.

Figure 6 . After finishing only 1 session of vital teeth bleaching: The border line between tetracycline-affected area and non-affected area, which was hypocalcified, could be recognized.

treatment. No damage to the vital pulp and hard tissue crystals are other benefits; however, future studies should confirm this. Slight injury to the gingiva cannot always be prevented, so the protecting and healing methods must be improved. Hypersensitivity and gingival injury after bleaching must be avoided. Careful case selection is recommended.

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