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# Diode Laser Tooth Whitening Improved Enamel Luminosity: A Case of Digital Photometry

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**Abstract:** Tooth whitening is a common procedure used to improve appearance of a discolored tooth. Many parameters have been described that based on the chemical influence of the bleaching agent on enamel-dentin surface. The final appearance may be compatible to the "brightness" of the tooth surface. In other terms the reflection of light from the bleached tooth area was assessed using digital methods. Luminosity as a method of photometry on measuring the luminance of basic colors may be considered as the simplest method of measuring the light reflection of green, blue and red. Concluding, the use of 38% hydrogen peroxide supported by diode laser slightly increased luminosity using digital photometry.

**Key words:** Diode laser, tooth whitening, enamal luminosity, digital photometry

## INTRODUCTION

Currently tooth bleaching is a common dental practice related to aesthetic improvement of various enamel discolorations. Any aesthetic approach in dentistry may be classically related to well informative techniques. Nowadays, the role of laser bleaching is induced powerfully in the literature (Zhang *et al*., 2007). The clinical role of chemically induced tooth bleaching seemed to be converted to light and chemical combinative procedure. The most known implicated light sources in the procedure of tooth bleaching may be various light curing units and some types of laser (Baik *et al*., 2001; Buchalla and Attin, 2007).

Diode laser is one of the newest dental laser equipments used for various dental procedures. The advantages and disadvantages of diode laser in treating dentine hypersensitivity, gingival hyperplasia, apthous ulcers, small benign tumors, fistula, root canal and periodontitis were not very clearly estimated (Romanos and Nentwig, 1999; Ciancio, 2006; da Costa Ribeiro *et al*., 2007; Kafas *et al*., 2008). Furthermore, in the procedure of light stimulating tooth whitening the importance of light emission is under scientific consideration (Dostalova *et al*., 2004).

It was our clinical interest to evaluate the importance of diode laser emission on 38% hydrogen peroxide, red colored bleaching chemical that applied on tooth surface. The role of Adobe[R] Photoshop[R] 6.0 software is described on assessment of the final luminosity.

## CASE REPORT

A female patient, 38 years old presented to the clinic for evaluation of a tooth discoloration. The upper right central incisor was periapically x-rayed showing that tooth was not endodontically treated. The electric pulp test and the ethylene oxide cold appliance revealed that tooth was non vital probably from chronic traumatic occlusion. It was decided primarily to perform root canal treatment and secondly a diode laser stimulated tooth whitening.

After completing the endodontic treatment the tooth bleached in three sessions of 20 min using the same parameters. The red colored 38% hydrogen peroxide gel used on the external surface of the coronal discolored part after isolation of the associated gingivae using a thin layer of white photopolymerizing gingival barrier. The technical parameters used for the diode laser were, 2000 mW of continuous emission on a spherical whitening handpiece. The tooth treated with laser for 4 min per session. Concurrently, internal chemical bleaching performed after sealing the pulp cavity with glass ionomer base to prevent entrance of the bleaching material into the root micro-gaps.

Prior to bleaching treatment the tooth color assessed using Vita[R] colorimeter. Initially the tooth colour was A3,5. After the first session the color was A3 and at the end of the second session the color was A2. Finally the color was very close to B1 of the upper left central incisor. The bleaching found to be effective with clear aesthetic improvement (Fig. 1 and 2).

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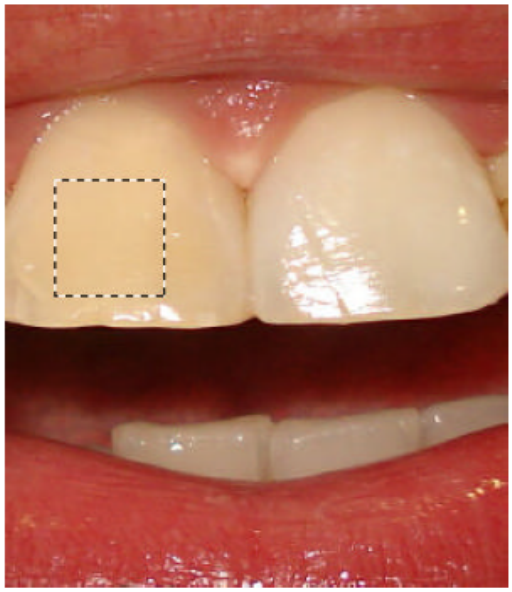

Fig. 1: The area of upper right central incisor which used in photometric evaluation before bleaching

Fig. 2: The area of the bleached surface of the upper right central incisor which used in luminosity measurement

The Adobe® Photoshop® 6.0 computer software has been used for the evaluation of the tooth luminosity on serial digital photographs of initially effective 6.000.000 pixels and high sensitivity (ISO 1000). According to the data which processed on the software the enamel luminosity was slightly increased after whitening.

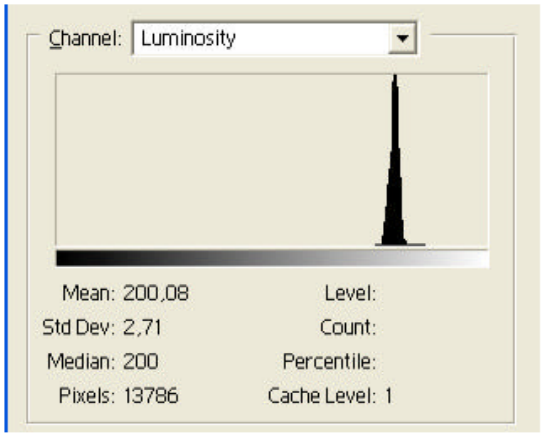


Fig. 3: The mean luminosity was measured on histogram before tooth whitening

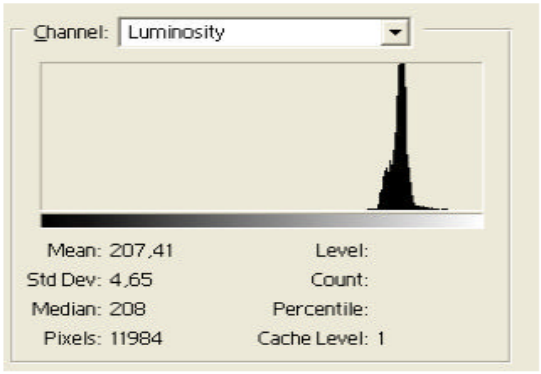


Fig. 4: The luminosity histogram after tooth bleaching. The mean was found 207,41

## DISCUSSION

Luminosity may be defined as the perceived brightness of an object or surface or reflecting light (Keil, 2007). According to this case report, tooth whitening may gradually cause increased luminosity. This characteristic may be hardly identified without specific digital technology. In our case mean luminosity before tooth whitening measured to be 200,08 where after the procedure being 207,41. This small improvement on enamel luminosity had not any significant effect on the appearance of bleached tooth and considered to be safe for this reason.

The physical phenomenon of light reflection may be measured by assessing the three basic colour means. Therefore main colours such as green, blue and red may be processed digitally for giving the total result of luminosity (Fig. 3 and 4). In general the peak of luminosity was not altered dramatically if each of the basic colours

measured, respectively. The main feature which altered was the horizontal range of the peak due to different light spectrum.

The role of light spectrum in the differentiation of luminosity may be characterized by its evaluation complexity. If the surface of examination is perpendicular to the direction of spread of the beam then the results considered as true. False results may be possibly found when the examined surface had an oblique relation to the direction of propagation of the beam. Therefore, the more obliquely the light strikes a surface the lower the luminance.

In photometry, the unit of luminous intensity is called candela which is characterized by the given direction of a source that emits monochromatic radiation of frequency $540\times10^{12}$ Hz (Ronto and Tarzan, 1994). To evaluate luminosity may be important to understand the terms reflectivity, transmittance and absorbance.

Specific computer software's such as Adobe$^{R}$ Photoshop$^{R}$ may be used in the procedure of digital photometry (Lee *et al*., 2007). Up to date there are no special guidelines for the measurement of luminosity of bleached tooth after diode laser application on 38% hydrogen peroxide chemical agent. At this case report, the gradual increase of luminance after tooth bleaching should not considered important since it could not be observed by naked eye. Concluding, digital luminosity may be used in the evaluation of bleached agents. It seemed that slight increase of luminosity after tooth whitening may have an effective improve on final "brightness".

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