# Dental Bleaching Techniques: Hydrogen Peroxide Application vs Laser. Which is More Efficient?


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## Abstract

Teeth whitening is a clinical procedure that can be done in many ways usually using gels with carbamide or hydrogen peroxides. The main objective of this study is to compare two methods of teeth whitening: conventional (with 40% hydrogen peroxide gel) and laser method (with 45% hydrogen peroxide gel activated by diode laser). We analysed two groups of 10 patients, one for each method. The results lead to the conclusion that hydrogen peroxide activated by laser seems to be more efficient but it also brings more dental hypersensitivity at the end.

**Keywords:** Dental bleaching, hydrogen peroxide, laser

## INTRODUCTION

Teeth whitening is a complex clinical procedure influenced by many factors such as type of bleaching techniques (trays, tooth paste, laser, Zoom light); teeth size, anatomy and enamel depth; fluctuation and wavelength of irradiation; type, concentration, temperature, pH and type of activation of the bleaching agent [1].

Hydrogen-carbamide peroxide (10%) was used as bleaching agent in custom-made trays since 1960, first under the name of *Gly-Oxide* (Marion Merrell Dow, Kansas City, MO, USA), then as *Proxigel* (1989), which was a mixture between carbamide peroxide, water, glycerine, and Carbopol, and under many trade names until today [2]. In contact with enamel, carbamide peroxide (CP) decomposes itself into hydrogen peroxide (HP) and urea. HP generates a powerful oxidizing action and also leads to formation of other oxidative agents like per hydroxyl anions and hydroxyl radicals [3].

Using laser in addition to any bleaching agent can lead to a higher whitening effect on teeth surfaces. The laser energy break HP into water and free oxygen radicals which can remove the stain molecules [4].

### *Aim and objectives*

The main objective of this study is to compare two method of teeth whitening: conventional method with HP 40% (Opalescence Boost) and Laser White 20 Gel HP 45% activated by Diode Laser (Biolase)

## MATERIAL AND METHODS

The clinical study was conducted over a period of 2 years and had two groups of 10 patients each, aged between 18-64 years. The first group was under the conventional teeth whitening method using HP 40% and the second group received HP 45% activated by diode laser (laser method).

The selection and the exclusion criteria for the two groups are in the table no. I:

Table 1. The selection and exclusion criteria for the patients included in this study

| Selection Criteria | Exclusion Criteria |
|---|---|
| – Exogenous discolorations<br>– Age-related discolorations<br>– Patients with unbroken and vital anterior teeth without carious lesions or restorations<br>– Completely erupted teeth | – Patients with periodontal disease<br>– Patients with gingivitis<br>– Gingival recessions<br>– Enamel structural defects<br>– Dental hypersensitivity<br>– Allergy to HP or methacrylate-based resins<br>– Adolescents under 18 years<br>– Pregnant or breastfeeding mothers<br>– Non-cooperative patients |

*Clinical protocol:*

The clinical protocol was conducted by one examiner. The initial teeth colour of every patient was fixed around midday on cloudy days. Photographs were taken using the same camera without a flash and under the light of the dental unit. The groups have been created to be balanced in gender, age, education level, dietary habits, and oral hygiene quality. There were 3 measurements of colour using the Vita Classic colour key: initial, intermediate and after the final application. When colour shade was unclear the Vita 3D-Master colour key was also used.

First, a professional cleaning was performed, including scaling and professional teeth brushing, followed by an antimicrobial treatment with a 2% chlorhexidine solution in cases of minimal signs of gingival inflammation. Scaling was performed using ultrasonic equipment and manual instruments followed by polishing with toothbrushes, rubber cups and professional toothpaste. In cases where scaling was not necessary, preparations consisted in brushing with low-speed brushes and professional fluoridated and abrasive toothpaste (RDA 250). Additionally, patients were advised to brush their teeth at home before the second session. After all these above the first picture was taken.

The first whitening session was 5-7 days after scaling to avoid hypersensitivity and protect the glycoprotein film which cover the enamel.

***Method applied to group no. 1 - Conventional Teeth Whitening Technique (CTWT):***

A whitening gel based on HP 40% with neutral pH was used. The gel consisted of 2 syringes of HP/Activator x 1.2 mL, one syringe of Opal Dam x 1.2 mL, and 5 micro tips 20 ga/5 micro tips 20 ga FX. After the cheeks and lips were retracted using a retractor and cotton rolls, the resin (Opal-Dam) was applied for gingival protection around the cervical area of the teeth and photopolymerized for 20-30 seconds. Vaseline was also applied for additional protection of the oral mucosa and commissures. After the transparent gel and the activator were mixed, it was applied on teeth surfaces and kept for approximately 20 minutes (figure no. 1). Then, the second picture were taken.

Figure 1. Whitening gel applied on teeth

The procedure continued with the second application. After 20 minutes, the excess of gel was removed with cotton rolls and the patients rinsed their mouth with water. When whitening gel was on teeth aspiration and rubber dam were always used. The final photographs were taken.

***Method applied to group no. 2 - Laser Teeth Whitening Technique (LTWT):***

First, the lips and cheeks were protected with vaseline and the cotton rolls were used for a better protection and a high comfort of the patient. After the Liquid Dam was put and polymerized the bleaching gel was also mixed and put using a brush applicator. A protective shield was used over the handpiece arch of the diode laser to prevent cross-contamination. The laser handpiece was connected and used on whitening mode, 7W for 30 seconds at 1 mm from the tooth surface with no direct contact with the whitening gel. The gel was left 5 minutes more after the laser then it was removed from the teeth. The first photographs were taken. The Laser White 20 whitening gel was reapplied using the same procedure mentioned above. The final photographs were taken followed by fluoride applications. The examiner and the patients wore glasses for their own protection.

The materials used in this procedure are presented in figure no. 2.


Figure 2. Biolase laser, hand piece and protective eyewear

The home care recommendations after the whitening procedures were: avoid smoking for a while, hot or cold drinks for 2 weeks, and beverage consumption such as tea, red wine, coffee, cola and others; a good oral hygiene and using tooth pastes for hypersensitivity (ex: with strontium chloride).

Clinical data were entered into a computer and processed with trial version 24 of SPSS software (Armonk, NY, USA).

## RESULTS

Two representative cases for the two whitening methods used in this study were shown in figures no. 3 and 4.


Figure 3. Conventional Teeth Whitening Technique (CTWT). 3 photos: initial (A), intermediate (B), final (C)

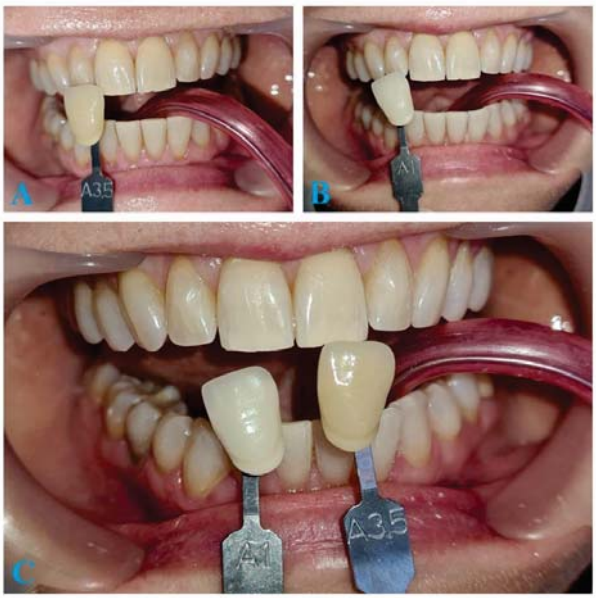


Figure 4. Laser Teeth Whitening Technique (LTWT). 3 photos: initial (A), intermediate (B), final (C)

The initial and final stages of teeth colour are graphical shown in figures no. 5 and 6:

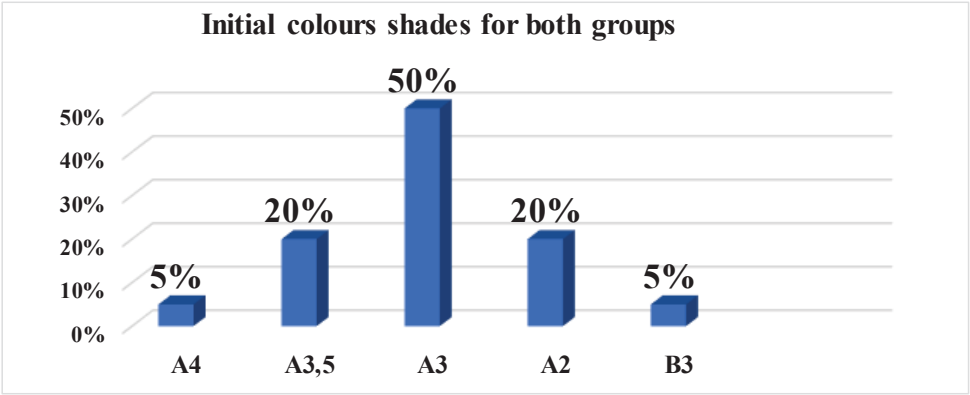


Figure 5. Initial colours shades for both groups of patients

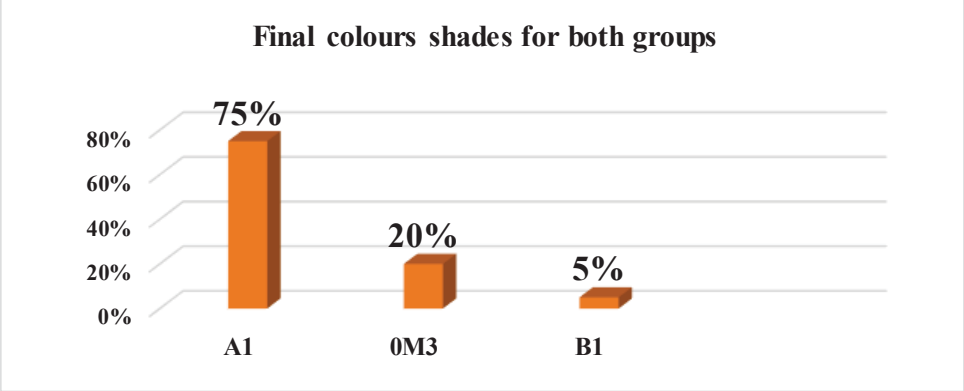


Figure 6. Final colours shades for both groups of patients

The efficiency of the 2 methods used in this study was measured counting the number of shades with which the teeth were whitened (figures 7 and 8)

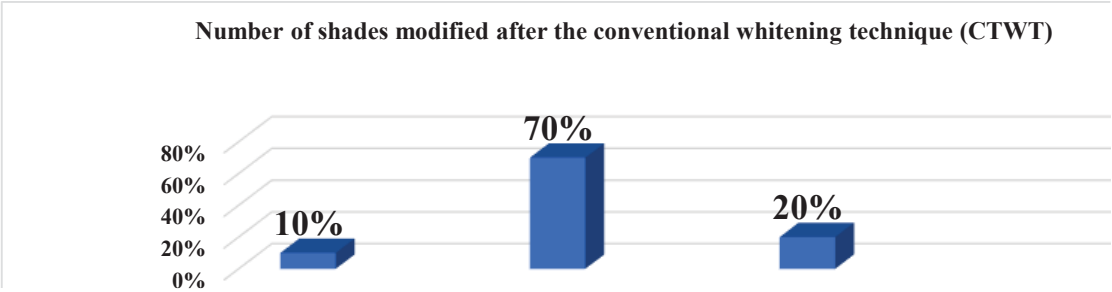


Figure 7. Efficiency of conventional whitening method

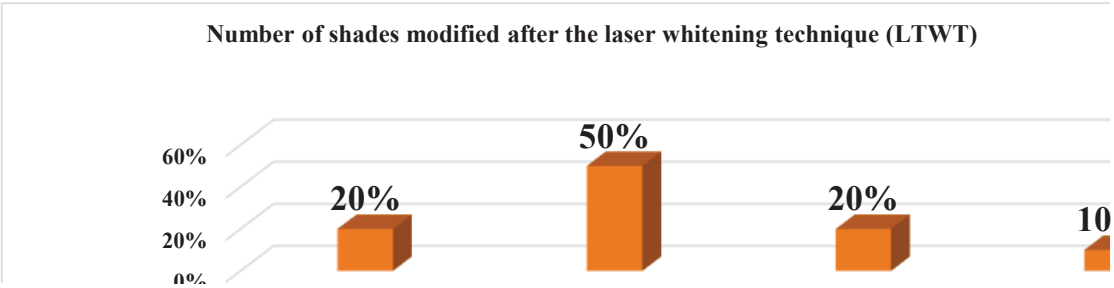


Figure 8. Efficiency of laser whitening method

The difference between initial and final colour shade was calculate for each patient and named *whitening difference* (WD). WD mean value was 1.8 (SE = 0.2) for the CTWT and 2.2 (SE = 0.58) for the LTWT.

50% of patients who whitening their teeth using CTWT had dental hypersensitivity at the end compared to 70% who used laser method.

## DISCUSSIONS

Our study showed a small difference between the two methods, LTWT being a little bit more efficient.

Some authors found a bigger differences when they used laser for teeth whitening. For example, Zang et al. found even 8.5 – 11 points difference for WD but they used a more accurate method for measuring the whitening effect and analyse the colour alterations of stained teeth (the International Commission on Illumination – CIELab) [5].

However, it is very difficult to compare those two methods because both of them use active HP (40% and 45%) and the fact that LTWT is more efficient may be because of laser or because of the different of 5% in HP concentration.

Moreover, LTWT methods are different and also it is very hard to compare the method used in this study with the results of other studies. De Moor et al. concluded that for studying efficiency of different LTWT methods we need three laser parameters: light intensity, spectral distribution, and irradiation time [6].

Speaking about side effects, LTWT led to 20% more cases of dental hypersensitivity in our study. However, laser can be also used to treat or prevent hypersensitivity [7]. Another approach will be to use a λ 450 nm blue laser delivered with a flattop beam profile. That seams to lead to a low inflammatory pulp response and to less pain (dental hypersensitivity) after the procedure [8].

## CONCLUSIONS

LTWT seems to be more efficient than conventional method but it looks like it has a higher percent of post-application dental hypersensitivity.

## REFERENCES


1. Féliz-Matos L, Hernández LM, Abreu N. Dental Bleaching Techniques; Hydrogen-carbamide Peroxides and Light Sources for Activation, an Update. Mini Review Article. Open Dent J. 2015 Jan 6;8:264-8.
2. Alqahtani MQ. Tooth-bleaching procedures and their controversial effects: A literature review. Saudi Dent J. 2014 Apr;26(2):33-46.
3. Llena C, Esteve I, Forner L. Effect of Hydrogen and Carbamide Peroxide in Bleaching, Enamel Morphology, and Mineral Composition: In vitro Study. J Contemp Dent Pract. 2017 Jul 1;18(7):576-582.
4. Mohammadi Z, Palazzi F, Giardino L. Laser application in tooth bleaching: an update review. Minerva Stomatol. 2011 Apr;60(4):167-78.
5. Zhang Q, Liu Y, Ding M, Yuwen L, Wang L. On-Demand Free Radical Release by Laser Irradiation for Photothermal-Thermodynamic Biofilm Inactivation and Tooth Whitening. Gels. 2023 Jul 7;9(7):554.
6. De Moor RJ, Verheyen J, Verheyen P, Diachuk A, Meire MA, De Coster PJ, De Bruyne M, Keulemans F. Laser teeth bleaching: evaluation of eventual side effects on enamel and the pulp and the efficiency in vitro and in vivo. ScientificWorldJournal. 2015;2015:835405.
7. Rezazadeh F, Dehghanian P, Jafarpour D. Laser Effects on the Prevention and Treatment of Dentinal Hypersensitivity: A Systematic Review. J Lasers Med Sci. 2019 Winter;10(1):1-11.
8. Hanna R, Miron IC, Benedicenti S. Feasibility and Safety of Adopting a New Approach in Delivering a 450 nm Blue Laser with a Flattop Beam Profile in Vital Tooth Whitening. A Clinical Case Series with an 8-Month Follow-Up. J Clin Med. 2024 Jan 16;13(2):491.