



COMPARING THE EFFECT OF LASER BLEACHING WITH HOME BLEACHING ON PAAN STAINED TEETH USING DIGITAL SPECTROPHOTOMETER

Dr. Kusum Valli S¹, Dr. Priyadarshini L Naik²

¹HOD, Department of Conservative Dentistry and Endodontics, Sri Rajiv Gandhi College of Dental Sciences and Hospital

²Post graduate student, Department of Conservative Dentistry and Endodontics, Sri Rajiv Gandhi College of Dental Sciences and Hospital

Conflicts of Interest: Nil

Corresponding author: Dr. Priyadarshini L Naik

DOI: <https://doi.org/10.32553/ijmsdr.v4i12.717>

Abstract:

Introduction: The demand for tooth whitening has increased dramatically with the resulting development of new tooth whitening products and procedures. As it is a common scenario that the dentists come across paan stained teeth very regularly in dental practice, the need for this study is to compare if laser bleaching or three day home bleaching is effective for paan stained and give better treatment options for patients.

Aim: To compare the effect of laser bleaching on paan stained tooth with home bleaching tooth using digital spectrophotometer

Methodology: 20 extracted teeth were preserved in a solution of normal saline with 1% thymol crystals. The teeth were immersed in staining solution containing paan extracts for a period of two week. The specimens were evaluated for pre shades using VitaEasyShade. The stained specimens for paan respectively were divided randomly into 2 groups one for laser bleaching and other for home bleaching. POLA OFFICE + was applied on tooth and activated using the diode laser as per the manufacturer's instructions for group 1. The bleaching was carried out with Philips Zoom Nitewhite for group 2. The second colour measurement of the specimens was made using VitaEasyShade.

Conclusion: The results showed that laser bleaching was effective when compared to three day home bleach in paan stained teeth using digital spectrophotometer.

Introduction

Patients can be dissatisfied with their tooth colour and request tooth whitening for a whiter smile. Thus demand for tooth whitening has increased dramatically with the resulting development of new tooth whitening products and procedures. It is of paramount importance for the practitioners to recognise and know the cause of discoloration to arrive at a correct diagnosis and hence successful treatment. In India the common cause of discolouration of teeth is attributed to chewing of paan and consumption of beverages. No studies have been performed to check the effect of bleaching on paan stained teeth. The dentists come across paan stained teeth very frequently in their practice, thus the aim of this study was to compare the effectiveness of laser bleaching with home bleaching of paan stained teeth and give better treatment options for patients.

The null hypothesis of the study was, there would be no difference in the shade of the specimens post bleaching and there would be no difference between shade change obtained between two groups that is laser bleach and home bleach.

Materials And Methodology

An in-vitro study was performed following the approval of ethical committee. Twenty human teeth which were

extracted for orthodontic purposes or due to periodontal problems were used for the study.

They met the following inclusion criteria

- Teeth with intact crowns, without any restorations or carious lesions.

The exclusion criteria included

- Teeth with restorations, caries, fractures, root canal treatments, crowns and any other damage

Specimen Preparation

A total of twenty freshly extracted teeth were preserved in a solution of normal saline with 1% thymol crystals and were debrided of any deposits such as plaque and calculus using ultrasonic scalers. The specimens (n=20) were randomly divided into two groups: Group 1 (n=10) for laser bleaching and Group 2 (n=10) for home bleaching. Next, the teeth were immersed in 200 ml of a freshly prepared paan extracts for a period of two weeks. The solution was shaken every day and changed every seven days. The temperature of staining solution was maintained at 37 degree. Following the staining procedure, the specimens were rinsed with tap water for ten (10) seconds and air dried.

Evaluation of Preshades

The samples were evaluated for pre shades using Vita Easy Shade spectrophotometer. Average shade of each sample

was measured and CIE L*a*b* values based on Rectilinear Cartesian co-ordinate system were recorded before the bleaching procedure. Readings were calculated using the ΔE^* values for each individual sample depicted on spectrophotometer using the formula - $\Delta E^* = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$

Laser Bleaching

Facial enamel surfaces were dried with air spray, before the process and the samples were mounted. The bleaching gel utilized for in-office bleaching procedure was 37% hydrogen peroxide Pola Office+. Teeth were bleached according to the bleaching protocol. Using the nozzle as a guide, layer ± 2 mm thick Pola Office+ of was spread over the samples in Group 1. A continuous motion was used for application on the entire tooth.

The gel was activated using the diode laser of 980nm wavelength and maximum output of 10 watt power. The laser activation was carried out for 30 seconds of 4 sessions each as recommended by the manufacturer. After the last application, all the gel was suctioned off. Then, the teeth were washed and air dried.

Home bleaching

Bleaching tray was fabricated for home bleaching procedure. One arch of ten samples were prepared for the fabrication of trays using polyvinyl acetate sheets and vacuum moulding unit. The bleaching gel utilized for home bleaching procedure was 22% carbamide peroxide Zoom Nitewhite. A small amount of gel was placed in each tooth compartment in the tray. The tray was placed over the samples in group 2. Care was taken not to push gel out of the tray and any excess gel was removed with a cotton swab. The trays were kept over the sample teeth for 6 hours. After whitening, trays were rinsed with cold water. A toothbrush was used to remove any residual gel from the trays and the trays were stored in a cool dry place. The teeth were rinsed to remove excess gel. Bleaching procedure was carried out for 3 consecutive days with 6 hours sessions per day.

Evaluation

After the end of the bleaching process for the different groups, the color of the teeth was again evaluated. For each specimen, variation of the values as (Δ) of L*, a* and b*, subtracting the value found after the bleaching from the values measured in the pre-treatment tooth was calculated using Vita Easy Shade spectrophotometer and change in the ΔE^* values for each individual sample was depicted on spectrophotometer using the formula - $\Delta E^* = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$



Figure 1: Labial surface of the pan stained teeth before bleaching



Figure 2: Labial surface of the pan stained teeth post laser bleaching

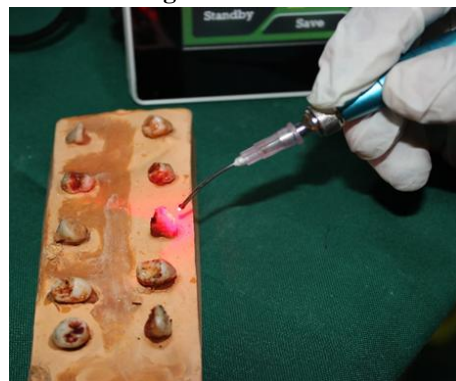
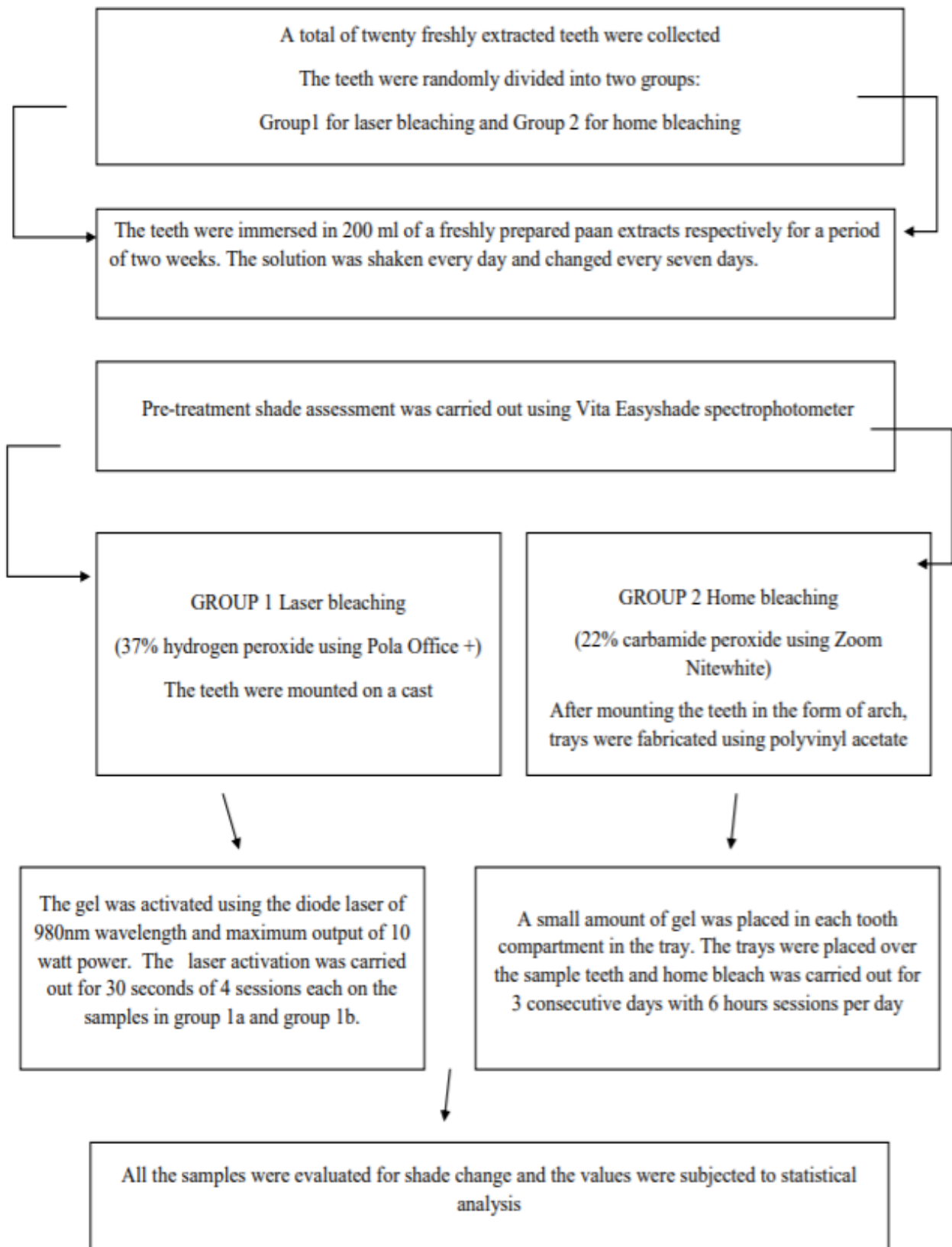


Figure 3: Application of the laser tip for laser bleach



Figure 4: Shade evaluation using Digital spectrophotometer

FLOWCHART



Statistical Analysis

A. The shade change in each sample was detected using the digital spectrophotometer and

B. Comparison of shade change between laser and the bleach group was done after mean was obtained and ANOVA with tukeys post hoc analysis was done

Results:

Table 1:

Shade Change		N	MEAN
Laser bleach	GROUP 1	10	31.88
Home bleach	GROUP 2	10	23.104
P value			0.0181777

On comparing the effectiveness of shade change ($\Delta E - \Delta E1$) between group I (Laser) and group II (home), group I appeared to show a higher mean value (31.88) than group II (23.104), suggestive of an increased shade change of group I than group II, the results being statistically significant. ($p=0.0181777$, $p<0.05$)

Discussion

Paan is composed of the nut of the areca palm (Areca catechu), the leaf of the betel pepper (Piper betel), and lime (calcium hydroxide). Only three drugs (nicotine, ethanol, and caffeine) are consumed more widely than betel¹⁵. When paan is chewed, there is copious production of a blood-red saliva that can stain oral structures. After years of chewing, the teeth may become red-brown to nearly black. Betel stains the teeth, gingiva, and oral mucosa in all regular users. The color ranges from red to black depending on the preparation and the number of years of use. The darkening has been reported to be caused by polymers of orthoquinones¹. The attraction of materials to tooth plays a critical role in deposition of extrinsic dental stain. These materials generate color due to presence of conjugated double bonds and are thought to interact with the tooth surface via an ion exchange mechanism leading to the stain formation². Various studies have been conducted to check the effect of bleaching on consumption of tea, wine and cola. But the effect of bleaching over paan stains is not known. **Thus, this study made use of paan for staining the teeth.**

Dental bleaching stands out among the various esthetic treatments because it involves a procedure that is **minimally invasive, easy to accomplish, has low cost and can lead to results that satisfy the expectations of both the patients and professionals.** Today the patients have the choice of getting the procedure done at dental clinic or at home.

The main advantage of in-office bleaching technique includes dentist control, reduced treatment time and enhanced patient satisfaction due to immediate results. Power bleaching using lasers was officially started with the approval of ion laser technology's argon and carbon dioxide

lasers by FDA in order to accelerate and enhance the bleaching process³. **One of the major disadvantages of laser bleaching is the cost of treatment thus making the patients choose other modes of tooth whitening.**

At home vital tooth bleaching has shown to produce significant perceivable change in colour, reduced dental appointments and chair time and has thus become popular. One drawback with the home bleaching is the reluctance to accept a procedure that takes several weeks and with that there is potential for poor patient compliance. The studies that have been performed previously use home bleach gel for 14 days to get effective results. **Newer products (like Zoom Nite White, Day White) that are ideal for patients looking for noticeable results as soon as possible from the comfort of home with the wear time of 2-4 hours for 3 days have recently been introduced in the market and thus the aim of the study was to compare 3 day home bleach with laser bleach.**

It is known that de-coloration can occur due to the breakup of a chromophore, and that destruction of one or more of the double bonds within the conjugated system is involved. **Thus, the dominant theory on the whitening mechanism is that stain molecules are oxidized into colorless compounds.**⁴

Hydrogen peroxide is unstable and can give rise to a number of reactive oxygen species. These include the hydroxyl radical, hydroperoxyl radical, hydroperoxyl radical anion, superoxide radical anion, and superoxide radical cation which to achieve stability, will generate other radicals. **The longer chain molecules then split in shorter chains which reflect light differently than its precursors and thus the tooth appears lighter.**

Hydrogen peroxide is one of the active ingredient used in tooth bleaching. Hydrogen peroxide may be applied directly or produced from sodium perborate or carbamide peroxide. Chemically, a 10% concentration of carbamide peroxide is composed of approximately 3.5 parts of H₂O₂ and 6.5 parts of urea.⁵ Various concentrations of tooth bleaching materials are being used. **This study made use of Pola Office + (37% Hydrogen peroxide) and Zoom Nitewhite (22% carbamide peroxide) for laser bleach and home bleach respectively.**

Verhyan et al (2006) **described the mechanism of absorption of laser light by bleaching gel** and suggested that hydrogen peroxide is optically clear which means that its ability to absorb visible light wavelengths is extremely low and without the addition of colouring agent, hydrogen peroxide will not be able to absorb any visible or infrared light. By choosing appropriate chromophores a range of processes can be triggered and absorbing energy will produce some localized heating which increases the production of reactive oxygen species, in proportion to the elevation of temperature. **Thus pigments with beta carotene, and others are added to the bleaching**

products to absorb the specific wavelength emitted by the device and increase the efficacy of the procedure.

According to a study conducted by Wetter et al 2004, the use of light source accelerates the chemical decomposition of hydrogen peroxide, hence achieving whiter smile in a short period of time.⁷ Aushill et al suggested that in order to achieve the desired six Vita Shade Guide tab changes with in-office bleaching 3.15 cycles of 15 minute each was necessary.⁸ **In this study, the gel was activated using the diode laser of 980nm wavelength and maximum output of 10 watt power. The laser activation was carried out for 30 seconds of 4 sessions each as it provides the most effective bleaching without raising the intrapulpal temperature and is also effective for single visits.**

Spectrophotometers are considered to be most accurate, useful and flexible instruments for overall color matching in dentistry. A spectrophotometer contains a source of optical radiation, a means of dispersing light, an optical system for measuring, a detector and a means of converting light obtained to a signal that can be analysed. Knezovic et al (2015) evaluated the of repeatability and accuracy of VITA Easyshade® Advance 4.0 dental shade-matching device in in-vitro and invivo models and found the device repeatability for *in vivo* measurements ranged from 0.858 to 0.971 and for *in vitro* from 0.992 to 0.994. Accuracy of the device tested was 93.75% with conclusion that it enabled reliable and accurate measurement and can be a valuable tool for the determination of tooth colours.⁹ **Thus in-order to avoid operator bias during shade analysis, Vita Easy Shade digital spectrophotometer was used in this study.**

It was found that patient compliance was better with night wear than day wear of the trays.¹¹ In order to check if active bleaching was occurring after the first two hours of bleach Haywood compared Opalescence and Platinum, in an invivo study and the found that after 4 hours, more than 60 percent of each material was remaining and active in the mouth guard which lead to conclusion that if the loaded material is removed too soon the active material would be wasted.¹⁰ **Thus in this study the wear time considered was 6 hours per day.**

Few studies showed enhanced bleaching results on using laser^{12, 14} while other studies showed no significant improvement.⁵ In the present study, laser activation produced comparatively enhanced bleaching efficacy with hydrogen peroxide gel when compared to home bleach group, which is in correlation with the results obtained by Bhutani et al¹³

From this study, it can be concluded that for paan stained tooth diode laser activation of 37% hydrogen peroxide tooth bleaching is an effective treatment option, as it provides faster bleaching without causing any thermal damage and that the reduced time frame when utilizing power tooth bleaching will result in better patient compliance and satisfaction when compared to home bleach.

Conclusion

On the basis of results obtained from the present study, following conclusions can be drawn: 1.Both the groups produced significant increase in lightness following bleaching.

2. On comparing in-office laser activation bleaching (37% hydrogen peroxide) with at-home bleaching (22% carbamide peroxide) it can be concluded that laser bleaching is effective when compared to home bleach for paan stained teeth.(statistically significant with p value <0.05)

References

1. Norton SA. Betel: consumption and consequences. Journal of the American Academy of Dermatology. 1998 Jan 1;38(1):81-8.
2. Nathoo SA. The chemistry and mechanisms of extrinsic and intrinsic discoloration. The Journal of the American Dental Association. 1997 Apr 1;128:6S-10S.
3. Greenwall L, editor. Bleaching techniques in restorative dentistry - An illustrated guide. Martin Dunitz Ltd; 2001
4. Kwon SR, Wertz PW. Review of the mechanism of tooth whitening. Journal of Esthetic and Restorative Dentistry. 2015 Sep;27(5):240-57.
5. Jala S, Ahuja R, Singh A, Abraham D. Comparative Evaluation of the Efficacy of In-Office Bleaching (37.5% Hydrogen Peroxide) and At-Home Bleaching (15% Carbamide Peroxide) Using Different Activation Systems.
6. De Moor RJ, Verheyen J, Diachuk A, Verheyen P, Meire MA, De Coster PJ, Keulemans F, De Bruyne M, Walsh LJ. Insight in the chemistry of laser-activated dental bleaching. The Scientific World Journal. 2015 Jan 1;2015
7. Wetter NU, Barroso MC, Pelino JE. Dental bleaching efficacy with diode laser and LED irradiation: An in vitro study. Lasers in Surgery and Medicine 2004, 35(4):254-8.
8. Aushill TM, Schneider-Del Savio T, Hellwig E, Arweiler NB. Randomized clinical trial of the efficacy, tolerability and long term colour stability of two bleaching techniques: 18-month follow-up. Quintessence Int. 2012;43(8):683-94.
9. Knezović zlatarić d, Illeš D, Alajbeg IŽ, Žagar M. In vivo and in vitro evaluations of repeatability and accuracy of VITA Easyshade® Advance 4.0 dental shade-matching device. Acta stomatologica Croatica. 2015 Jun 18;49(2):112-8.
10. Nathoo SA, Richter R, Smith SF, Zhang YP. Kinetics of carbamide peroxide degradation in bleaching trays (Abstract no. 2149). J Dent Res 1996;75:286
11. Haywood VB. Current status of nightguard vital bleaching. Compendium. 2000 Jun 1;21(28):S10-7

12. Calatayud JO, Calatayud CO, Zaccagnini AO, Box MJ. Clinical efficacy of a bleaching system based on hydrogen peroxide with or without light activation. *Eur J Esthet Dent* 2010;5:216-24.
13. Bhutani N, Venigalla BS, Patil JP, Singh TV, Jyotsna SV, Jain A. Evaluation of bleaching efficacy of 37.5% hydrogen peroxide on human teeth using different modes of activations: An in vitro study. *Journal of Conservative Dentistry: JCD*. 2016 May;19(3):259.
14. Mondelli RF, Gabriel TR, Rizzante FA, Magalhães AC, Bombonatti JF, Ishikiriama SK. Do different bleaching protocols affect the enamel microhardness?. *European Journal of Dentistry*. 2015 Jan;9(1):25
15. Guha P. Betel leaf: the neglected green gold of India. *Journal of Human Ecology*. 2006 Feb 1;19(2):87-93