

Clinical Comparative Evaluation of Led and Diode Laser on Efficacy of 40% Hydrogen Peroxide on Tooth Whitening

Dr. Payal Patel, Dr. Kamal Bagda, Dr. Kailash Attur, Dr. Kiran Vachaani, Dr.Zarna Patel, Dr. Kruti Kachoriya

Dr. Payal Patel: MDS, conservative dentistry and endodontics; Consultant endodontist;

Dr. Kamal Bagda: MDS; Dean, Professor & Head of Department; Department of Conservative Dentistry & Endodontics; Goenka Research Institute of Dental Science; Pethapur-Mahudi Road, Near G.G.S, Piplaj, Gandhinagar- 382610,Gujarat.India;;

Dr. Kailash Attur: MDS ,Professor, Head; Department of Conservative Dentistry and Endodontics; Narsinhbhai Patel Dental College and hospital, Sankalchand Patel University,Visnagar;

Dr. Kiran Vachaani: MDS, Professor; Department of Conservative Dentistry and Endodontics; Narsinhbhai Patel Dental College and hospital, Sankalchand Patel University, Visnagar; H 404 Shilalekh, Near Subhash bridge, Shahibaug, Ahmedabad, 380004;

Dr.Zarna Patel: MDS, conservative dentistry and endodontics; Consultant endodontist;

Dr. Kruti Kachoriya: MDS ; Senior lecturer; Goenka Research Institute of Dental Science,33,saptarushi society, near krushnakunj flats, Kudasan, Gandhinagar -382421;

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|---|--|---------------------------------------|---------------------------------------|--|--|--|--|
| | ABSTRACT | | | | | | |
| KEYWORDS Vital bleaching, hvdrogen peroxide. | Introduction: Tooth | discoloration creates wide range | ge of cosmetic problems. Various | | | | |
| | methods are available | to remove stains. One of those me | ethods is tooth bleaching which can | | | | |
| LED, Laser, Shade | be done by vital or no | n vital methods. Bleaching process | s involves use of hydrogen peroxide | | | | |
| guide | and carbamide peroxi | de. These bleaching agents can be | activated by chemical, heat or light. | | | | |
| | Aim: To evaluate and compare the clinical chromatic scale and efficiency of teeth | | | | | | |
| | Whitening procedures | s performed with 40% hydrogen pe | roxide, LED activated and LASER | | | | |
| | activated, for the treat | ment of discolored teeth. | | | | | |
| | Materials and metho | od: Total 60 patients with the chief | f complaint of discoloration of teeth | | | | |
| | were included for the | study. Each patient was divided rate | ndomly into following three groups. | | | | |
| | Group 1: 40% hydrog | gen peroxide (n-20 patients), Grou | p 2: LED (n-20 patients), Group 3: | | | | |
| | Diode LASER (810nm) (n-20 patients). After explaining the treatment for discoloration | | | | | | |
| | consent was obtained. In all patients, before the bleaching treatment, full mouth oral | | | | | | |
| | prophylaxis was done | e. Isolation was done with rubber | dam. Gingival barrier was applied. | | | | |
| | Patient's chromatic s | scale score was noted with shad | de guide (vita classic) before the | | | | |
| | treatment. 40%Hydro | gen peroxide gel (opalescence Bo | oost) was applied on the discolored | | | | |
| | teeth according to ma | anufacturer's instruction in all 3 g | roups and the shade was evaluated | | | | |
| | with the shade guide (| (vita classic). | | | | | |
| | Result: There is high | significant difference present in co | olour change in various groups. The | | | | |
| | order of mean colour | change is | | | | | |
| | Group $3 > Group 2 >$ | Group 1 | | | | | |
| | Group 1 has the least | difference where as Group 3 has the | ne highest difference. | | | | |
| | Conclusion: Both dio | de laser-assisted and LED bleaching | ng techniques are capable of altering | | | | |
| | tooth colour change, b | out diode laser bleaching is signific | cantly a more efficient technique. | | | | |
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| | | | | | | | |



INTRODUCTION

In the era of modernization, a pleasing appearance often means the difference between success and failure in both our personal and professional lives. Scottish physiologist, pointed out in 1806 that a smile could convey a thousand different meanings, yet it is the most easily recognized expression because the mouth is one of the focal points of the face and it should come as no surprise that the smile plays a major role in how we perceive ourselves, as well as in the impressions we make on the people around us.^[1]

Tooth plays a major role in the beauty and personality of the individual. Achieving a pleasant smile that contributes much is nothing but the colour of the teeth. Attractive teeth have always been the typical patients' primary concern. In the past the dentist were often dismayed by a patient's disappointment in a perfect restoration. Today by taking full advantage of new materials and techniques dentists can often meet or even exceed such expectations. Colour of the tooth is of particular importance to the patient because of social and psychological concern. In fact matching the colour of the teeth with the adjacent teeth is one of the major motivations of the patient to seek for cosmetic dental treatment.^[2]

Colour of teeth has become a significant factor in attractiveness of smile. ^[4] Tooth colour is determined by a combination of the different optical properties of enamel, dentin and pulp. ^[3]

Tooth discoloration is defined as a combination of intrinsic and extrinsic staining. Ingle defines the tooth discoloration as "Any changes in the hue, colour of translucency of tooth due to any cause; restorative filling materials, drugs (both topical & systemic), pulpal necrosis, or haemorrhage may be responsible.^[4]

There are several ways to manage tooth discolouration, which include crowns, veneers, or

tooth bleaching .For crowns and veneers, these treatment options, there is a moderate loss of dental hard tissue.

Vital tooth bleaching is not only a less costly alternative to bonded restorative dentistry but also a conservative and non-invasive technique which has been well accepted to be safe and effective.^[5] Tooth bleaching is one of the most requested cosmetic dental procedures asked for by patients who want a more pleasing smile.^[6]

AIM

To evaluate and compare the clinical chromatic scale and efficiency of teeth

whitening procedures performed with 40% hydrogen peroxide, LED activated and LASER activated, for the treatment of discoloured teeth.

MATERIALS AND METHOD

Total 60 patients with the chief complaint of discoloured tooth and seeking for the treatment were selected from the department of Conservative Dentistry and Endodontics, Narsinhbhai Patel Dental College and hospital, Sankalchand Patel University Campus Visnagar, Gujarat and were divided randomly into following three groups.

1. Group 1: 40% hydrogen peroxide (n-20 patients)

2. Group 2: LED (n-20 patients)

3. Group 3: Diode LASER (810nm) (n-20 patients)

• After explaining the treatment for discoloration consent form was signed. In all patients, before the bleaching treatment, full mouth oral prophylaxis was done.

• Isolation was done with rubber dam. Gingival barrier was applied. Patient's chromatic scale score was noted using shade guide (vita classic) before the treatment.

• Shade tabs were arranged and ranked in value order

| B1 | A1 | B2 | D2 | A2 | C1 | C2 | D4 | A3 | D3 | B3 | A3.5 | B4 | C3 | A4 | C4 |
|----|----|----|----|----|----|----|----|----|----|----|------|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

• In **Group 1**: 40% Hydrogen peroxide gel (opalescence boost tooth whitening system) was applied on the discoloured teeth based on manufacture's instruction and the shade was evaluated with shade guide. • In **Group 2**: 40% Hydrogen peroxide gel (opalescence boost tooth whitening system) was applied on the discoloured teeth based on manufacture's instruction and activated by LED light than the shade was evaluated with shade guide.

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• In **Group 3**: 40% Hydrogen peroxide gel (opalescence boost tooth whitening system) was applied on the discoloured teeth based on manufacture's instruction and activated by Diode LASER (810nm) then the shade was evaluated with shade guide.

Group 1: Bleaching without application of light





Application of bleaching agent

Application of optradam



Post operative

Group 2: Bleaching with application of LED light



Pre operative

Application of optradam bleaching agent applied



Activation by LED light

Post operative

Group 3: Bleaching with application of diode laser

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Pre operative

Application of optradam bleaching agent applied



Activated by diode laser



Post operative

RESULT

Data was analyzed using SPSS version 23. Descriptive for scale data, one way ANOVA with post hoc tukey test for inter-group comparison

| Group | Duration | Mean | N | Std | Std | Mean | P value |
|---------|------------|--------|----|-----------|-------|------------|----------|
| oroup | 2 41411011 | 1.100 | | Deviation | Error | Difference | 1 (0100 |
| | | | | | Mean | | |
| Group 1 | Pre | 11.150 | 20 | 3.0136 | .6739 | 7.31 | <0.001** |
| | Post | 8.250 | 20 | 3.5964 | .8042 | | |
| Group 2 | Pre | 11.650 | 20 | 2.5808 | .5771 | 12.434 | <0.001** |
| | Post | 6.400 | 20 | 2.3033 | .5150 | | |
| Group 3 | Pre | 12.250 | 20 | 2.5930 | .5798 | 15.226 | <0.001** |
| | Post | 4.900 | 20 | 2.1001 | .4696 | | |

Table 1: Intra group comparison of color change (Pre-Post Treatment)

**-Highly significant (p<0.001

Graph 1: Intra-group comparison of mean color change

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 Table 2: Intergroup comparison of difference in colour change

| Group: | Ν | Minimum | Maximum | Mean | Std. | F value | P value |
|---------|----|---------|---------|------|-----------|---------|-----------|
| | | | | | Deviation | | |
| Group 1 | 20 | 1 | 7 | 2.90 | 1.774 | 26.144 | < 0.001** |
| Group 2 | 20 | 3 | 12 | 5.25 | 1.888 | | |
| Group 3 | 20 | 5 | 13 | 7.35 | 2.159 | | |

**-Highly significant (p<0.001)

There is a statistically significant difference present in mean colour change in various groups. ANOVA table signifies overall comparison.



The order of mean colour change is Group 3 > Group 2 > Group 1



DISCUSSION

The smile is considered to be indispensable for communication, and thus people's craving for white teeth have forced dentists to seek solutions that satisfy patient's expectations for an aesthetically pleasing smile. ^[7]

Carbamide peroxide and Hydrogen peroxide are the active ingredients used in tooth bleaching process regardless of the bleaching technique used. H_2O_2 is considered as the true active ingredient used in case of tooth bleaching. Various concentrations of tooth bleaching materials are being used, ranging from 25% to 40% for in-office bleaching.^[8]

The aim of this present study is to evaluate and compare the clinical chromatic scale and efficiency of teeth whitening procedures performed with 40% hydrogen peroxide, LED activated and LASER activated, for the treatment of discoloured teeth.

In this clinical study, an in-office vital tooth bleaching using 40% hydrogen peroxide was performed. This treatment has become very popular in the last few years because it is a simple procedure to perform and patients undergoing this procedure can see an immediate effect. ^[9]

To limit the confounding variables, only one bleaching agent was used in all of the groups tested. This facilitated a comparison of the effect the different light sources had on colour change.

The two main side effects for this treatment modality are gingival irritation and tooth sensitivity. ^[9] Gingival irritation is usually due to the irritation from the high concentration of the bleaching agent if it comes in contact with the gingival tissues. Gingival irritation did not occur in the present study because care was taken to apply a protective resin over the gingiva.

40% hydrogen peroxide contains potassium nitrate and fluoride – minimizing sensitivity, providing anti-caries benefits, and increasing enamel microhardness.

The VITA Classic Shade Guide® was used for the visual evaluation in this study because determination of the shade of a patient's teeth by comparing the colour of their teeth with a commercially available dental shade guide is the most frequently applied method in clinical practice. Besides being simple and a quick procedure^[9,10], this method has been used successfully in similar studies

The theory behind using activation light with inoffice bleaching is that the light will speed the breakdown of the hydrogen peroxide and thus lighten the teeth more rapidly. The assumed benefit is that the procedure is less time-consuming while producing faster results.^[11]

According to a study conducted by Domínguez et al 2011, the light source is more important than the bleaching agent in the whitening process. ^[12] where as Alomari and El Dara performed a randomized clinical trial of in-office dental bleaching with and without light activation, and found that using light activation with in-office bleaching seems to increase the efficacy of treatment for a short period of time only (immediately after bleaching) but there was no significant change in long-term results (measured at one month post treatment) between the light-activated and without light groups. ^[10]

Today LED lights are available across the visible, ultraviolet and infrared spectrum of wavelengths. The LED light system investigated in this study is marked as a blue LED light which means the wavelength should be between 450 and 500 nm. It is also reported that LEDs can emit light of an intended colour without using any colour filters as in traditional lighting methods.

Lasers have an added advantage of being quick and have minimal or no after treatment sensitivity or gingival irritations that is often encountered with the incoherent light sources

Epic 10 BIOLASE diode laser was used in this study which is a IV generation laser, having a wavelength of 940 ± 10 nm and maximum power output of 10 watt. The Laser worked in a continuous pulsed mode with a pulse duration of 0.01ms – 20ms. This diode laser works under the InGaAaP Semiconductor medium.

Diode laser with the power setting of 10 watt and with activation time of 30 seconds was used as it provides the most effective bleaching without raising the intrapulpal temperature and can be used as a single visit bleaching process. ^[13]

CONCLUSION

Within the limitations of the current study, the following conclusions can be drawn:

1. In office- bleaching, with and without light, is effective to bleach teeth.

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- 2. The use of light-activation sources (LED and LASER) did affect the initial outcome of inoffice vital tooth bleaching when used in conjunction with 40% hydrogen peroxide
- Both diode laser-assisted and LED bleaching techniques are capable of altering tooth colour change, but diode laser bleaching is significantly more efficient technique in this regard

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