

A Comparative evaluation of the bleaching efficacy of a recent herbal extract versus other bleaching aids for discoloured teeth: An ex-vivo study

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ABSTRACT

Aim & Objective

To evaluate and compare the bleaching efficacy of a recent herbal extract versus other bleaching aids for discoloured teeth: An ex-vivo study.

Method

In this ex-vivo study fifty human permanent anterior teeth were collected. The samples were divided into five groups: Group A: Control Group, Group B: iWhite Instant, Group C: Ammdent Ultra white bleaching gel, Group D: 1% Bromelain (Herbal agent) and Group E: Laser Smile bleaching gel. Following the recommended bleaching protocol, samples were subjected for bleaching efficacy and colour analysis using UV spectrophotometer.

Results

The result showed statistically significant difference among the mean of 4 experimental and 1 control group (P-value < 0.001). On evaluation and comparison, the bleaching efficacy of Group E where laser-activated bleaching was employed showed better bleaching efficacy evaluated with ΔE_3 Mean \pm SD values at 8.8 ± 0.35 when compared to Groups A (0.0 ± 0.0), B (5.4 ± 0.32), C (7.0 ± 0.40) and D (3.8 ± 0.35) which did not employ the laser.

Conclusion

Laser smile bleaching gel showed maximum bleaching efficacy followed by Ammdent ultra white bleaching gel > iWhite instant and > 1% Bromelain gel.

Keywords: Bleaching efficacy, Herbal extract, Bromelain, Laser activated bleaching, Discoloured teeth, Ex-vivo study, Tooth whitening.

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INTRODUCTION

Today's aesthetic concern has peaked its steps, so as to achieve a harmonious smile with more whiter teeth have increased tremendously in recent years.¹ Tooth discoloration can be either of intrinsic or extrinsic origin.²

Extrinsic discoloration can be easily corrected by an aesthetic procedure called as bleaching in which chemical agents are able to diffuse through the tooth surface, releasing free radicals that oxidize organic pigments that causes discoloration of the teeth structure and, thus, cause whitening.³

Tooth bleaching is one of the most non-invasive dental treatments to improve people's appearance, and has become one of the fastest leading zones in aesthetic dentistry.⁴

Clinically the most commonly used bleaching agents are hydrogen peroxide, carbamide

peroxide and sodium perborate, either used alone or in combination.⁵

Tooth-whitening with peroxides is generally considered a safe and effective procedure. The drawback however, is that it is known to temporarily increase teeth sensitivity, which affects 43% to 80% of patients after whitening their teeth with peroxides.^{6,7,8}

The novel OTC teeth-whitening products contains a range of active ingredients, such as phthalimidoperoxycaproic acid (PAP), sodium chlorite or sodium bicarbonate.⁹ PAP, is an organic peroxide, oxidizes chromogens without the formation of free radicals, due to epoxidation of molecules containing conjugated double bonds.⁹

To solve this issue, recently, LASER has been introduced giving its promising role, in the field of aesthetic dentistry.¹⁰ Recent studies have reported that the diode laser-activated

whitening method has several advantages, including its speed of action, low sensitivity, minimal heat increases in the canal system.^{11,12}

Another alternative to counteract the drawbacks associated with peroxides bleaching, is the use of natural compounds. Given their natural origin, these types of products have a certain guarantee on their non-toxic biological behaviour, resulting in little or no harmful effects.¹³

In the recent literature, natural compounds, such as enzymes, have been listed as alternative whitening agents. Bromelain, papain and cysteine proteases of natural origin have recently been tested as whitening gels in vitro and as dentifrices in vivo and in vitro.^{14,15,16,17}

The tooth colour and the results of bleaching can be measured by subjective methods and objective instruments.¹⁸ The use of instrumental methods, such as spectrophotometers and digital cameras, facilitates colour evaluation and presents more accurate and objective results.^{19,20,21}

Keeping in view this surge, with increasing demands of aesthetic dental services and the use of different agents worldwide via different bleaching methods, the objective of this ex-vivo study is to evaluate and compare the efficiency of recently introduced herbal extract as bleaching agent with other aids for vital tooth bleaching using spectrophotometric colour analysis.

METHOD

50 Human Permanent Single rooted anterior teeth were chosen as per inclusion and exclusion criteria. They were cleaned, decontaminated and disinfected by immersion into 0.2% thymol solution for 48 hours and thereafter were stored in glass beaker containing normal saline (0.9% W/V) until further use. The shade of each sample were observed down before staining the sample. Stains were induced using 1 tea bag by boiling it in 100ml of distilled water for 5 minutes thereby immersing the samples in a 100 ml glass beaker containing tea without milk or sugar, at room temperature for 7 days, which were renewed on daily basis.

After staining samples were randomly divided into 5 experimental groups (n=10 each). Group A being the Control Group where no bleaching aid was tested on these samples. In Group B, bleaching was performed on the facial surfaces using iWhite Instant. Group C samples were bleached using Ammdent Ultra white bleaching gel. Group D samples were bleached using recent 1% Bromelain herbal extract. Group E samples underwent bleaching using Laser Smile bleaching gel which was activated by diode laser ($\lambda = 810$ nm) in 7 minutes and 4 minutes intervals, according to the manufacturer's recommendation. Bleaching protocol followed was as per manufacturer instructions. For Group D, the herbal extract made (1% Bromelain gel) does not had any standardized

application protocol, so gel was applied following a protocol based on previous studies. This procedure was repeated four times, with a 1-week time interval simulating four clinical applications. Between each application, the specimens were kept in artificial saliva in a glass beaker. Followed bleaching, the samples of all the groups were stored in normal saline in a glass beaker. The final output of the entire bleaching procedure was kept as close to the initial colour before staining for each sample. Post bleaching, all the samples were subjected to colour analysis {the initial sample colour(I), the colour after 7 days of staining procedure (II) and (III) Colour after 7 days whitening procedure} using Spectrophotometer to access bleaching efficacy.

RESULTS

At baseline, all groups exhibited comparable pre-stain L* values ranging from 85.3 ± 0.5 to 85.6 ± 0.5 , indicating uniform initial tooth colour. Following staining, a marked reduction in L* values was observed across all groups, with post-stain values around 38.2 ± 0.3 to 38.4 ± 0.3 , confirming effective and consistent staining. After bleaching, the control group showed no change (38.2 ± 0.3), whereas experimental groups demonstrated an increase in L* values, with the highest mean lightness observed in Group E (72.5 ± 0.8), followed by Group C (68.9 ± 0.7), Group B (65.9 ± 0.7), and Group D (63.1 ± 0.8). Laser Smile Gel with laser activation (Group E) demonstrated the highest bleaching efficacy, followed by Ammdent Ultra White (Group C), iWhite Supreme (Group B), 1% Bromelain (Group D), while the control group showed no effect.

DISCUSSION

Management of discoloured dentition in oral cavity has become a common procedure in our day-to-day practice. The study evaluated and compared the bleaching efficacy of iWhite Instant, Ammdent ultra white bleaching gel, Bromelain (1%), a herbal extract and Laser smile gel on discoloured teeth.

The colour change values obtained were analysed on the basis of CIE (International Commission on Illumination) values. The use of L*a*b values were recommended by CIE because they are closer to human perception.^{22,23,24,25}

In the present study, Group E where laser-activated bleaching was employed fared better overall in bleaching efficacy evaluated with ΔE_s Mean \pm SD values at 8.8 ± 0.35 when compared to groups A, B (5.4 ± 0.32), C (7.0 ± 0.40) and D (3.8 ± 0.35) which did not employ the laser. Epic X BIOLASE diode laser was used in the 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. Study by Al-Karadaghi TS et al on the use of laser for whitening procedures has shown that 940 nm diode laser photoactivation

produced the largest colour change.²⁶ In-office bleaching agents can be activated by light or heat.²⁷ Shorter wavelengths such as potassium titanium phosphate lasers, argon, and diode lasers are commonly used for in-office bleaching treatments.²⁸ Luk et al. reported that the interaction of the bleaching agent with light variables significantly affected colour change and opined that the whitening efficacy of some bleaching materials was significantly improved by the application of light.²⁹ Dental lasers are a relatively novel treatment approach for teeth bleaching and are considered to be the most prized energy source for power bleaching with a simple and short application time.³⁰ Dominguez et al. examined the whitening efficacy of three whitening agents in combination with six different photoactivation systems. They concluded that only the groups that were photoactivated using a diode laser, halogen lamp, and light-emitting diode (LED) showed statistically significant differences ($p = 0.005$) in colour change when compared with the control groups (without photoactivation).^{31,32} According to the observations and results of the present study it was concluded that the bleaching efficacy was the most superior of the group treated with Laser Smile bleaching gel (Group E), followed by Ammdent Ultra white bleaching gel (Group C), iWhite Instant (Group B), and 1% Bromelain (Herbal agent) (Group D).

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