



EFFECT OF HYDROGEN PEROXIDE CONTAINING EXTRACT OF PINEAPPLE & PAPAYA AS AN ADDITIVE ON HUMAN ENAMEL DURING VITAL BLEACHING USING REFLECTANCE SPECTROPHOTOMETER: AN IN VITRO STUDY

Dental Science

Dr. Meenakshi Choudhary*	Post Graduate student, Department of Conservative Dentistry and Endodontics, School of Dental Sciences, Sharda University, Greater Noida *Corresponding Author
Dr. G Ratna Velugu	Reader, Department of Conservative Dentistry and Endodontics, School of Dental Sciences, Sharda University, Greater Noida
Dr. Ekta Choudhary	Professor and Head, Department of Conservative Dentistry and Endodontics, School of Dental Sciences, Sharda University, Greater Noida

ABSTRACT

Aim: To evaluate bleaching efficiency of solutions containing hydrogen peroxide and extract of Pineapple & Papaya as an additive on human enamel in two different timings, using reflectance spectrophotometer

Materials and Methods: Baseline color values of 20 randomly selected artificially stained incisors were obtained. The specimens were divided into three groups of 40 teeth each: Group 1 – 30% hydrogen peroxide, Group II – Hydrogen peroxide with Pineapple extract, and Group III – Hydrogen peroxide with Papaya extract. They were further divided into 2 subgroups, according to time of bleaching, i.e. 20 min (Subgroup A) and 10 min (Subgroup B).

Statistical Analysis: The results were statistically analysed using using Kruskal Wallis test

Results: The mean ΔE values of Group 1A (11.49), Group 2A (12.57), and Group 3A (15.82) showed higher values when compared to the mean ΔE values of Group 1B (10.74), Group 2B (12.21), and Group 3B (15.60).

Conclusion: Natural enzymes enhances the bleaching effect when used along with hydrogen peroxide.

KEYWORDS

Bleaching, Bromelain, Papain, Spectrophotometer

INTRODUCTION:

Several corrective measures were introduced in the field of esthetic dentistry to treat discolored teeth. Laminate veneers, direct resin restorations, crowns or fixed prostheses were included in those corrective measures. A conservative treatment option i.e. dental bleaching is useful when restorative procedures are performed to correct color abnormalities¹

Tobacco, tea, coffee, red wine, medicines etc. can cause extrinsic staining of teeth. These substances contains chromogens, (e.g. polyvalent metal salts in iron supplements and cation antiseptics in chlorhexidine) that may get attached to the tooth, and creates black or brown characteristic stains.²

Prophylactic procedures are successful in removing the extrinsic stains; but persistent stains requires bleaching procedure.³

One of the most effective tooth bleaching agents is the hydrogen peroxide, whose application in dentistry was described by Harlan as early as 1884.⁴

Although hydrogen peroxide provides better outstanding results, the related clinical side effects remains inevitable. The scientific evidence of change in surface texture, composition, and micro hardness of enamel are reported when bleaching is done with hydrogen peroxide.⁵

The enzymes like Proteases could help degrade the stained films as extrinsic stains are incorporated in pellicle. Papaya is a compatible bleaching agent due to presence of proteolytic enzymes such as papain and chymopapain. Some *in vitro* study reported that a dentifrice containing papain and Bromelain were helpful in removing stains than the dentifrice without them.⁶

AIM:

To evaluate bleaching efficiency of solutions containing hydrogen peroxide and extract of Pineapple & Papaya as an additive on human enamel in two different timings, using reflectance spectrophotometer.

MATERIALS & METHODS:

Specimen collection

One hundred twenty maxillary central incisors were collected that were extracted due to periodontal disease. The defective teeth (i.e. the one with visible cracks, caries defects, and decalcifications) were discarded. Then, the teeth were cleaned of calculus and the remaining

soft tissue using an ultrasonic scalar (Satelec, India). They were stored in 0.2% Thymol, and refrigerated at 4°C until use.

Preparation of pineapple extract

Two hundred grams of pineapple were peeled and cut into small pieces. The pieces were smashed and blended in a blender with 25 ml of distilled water. The obtained filtrate was further centrifuged at 2000 rpm for 2 min at a temperature of 4°C. The clear liquid was filtered out and refrigerated at 4°C.

Preparation of Papaya extract

Unripe papaya was washed with distilled water, peeled, deseeded and the flesh was blended in a blender. Papaya pulp was squeezed through a mesh cloth to produce the unripe pulp juice (UPJ). The UPJ was centrifuged at 2000 RPM at 4°C for 15 minutes. Then the supernatant was filtered using a sterile 0.22 μm syringe filter. The sterilized UPJ was used immediately.

Staining of specimen

Deionized water (100 ml) was boiled and a tea bag was dipped into it. The solution was cooled to room temperature after 5 min. The strained solution was used for staining. Staining was achieved by immersing the teeth for 24 h in this solution. The teeth were properly washed and stored at 37°C, 100% humidity.

Baseline color value

Baseline color values were established by randomly selecting twenty stained specimens. Specimens were measured over a white background using a reflectance spectrophotometer (X-Rite Gretag Macbeth). This was helpful in recording the color variables in accordance with commission Internationale de l'Eclairage (CIE) laboratory system.

The teeth were randomly divided into three groups of 40 teeth each, based on the concentration of hydrogen peroxide as follows:

- Group 1 ($n=40$) – Hydrogen peroxide
- Group 2 ($n=40$) – Hydrogen peroxide with Pineapple extract
- Group 3 ($n=40$) – Hydrogen peroxide with Papaya extract

They were further subdivided into two subgroups of 20 teeth each
Subgroup A ($n=20$) – 20 min
Subgroup B ($n=20$) – 10 min

The crown and roots of all teeth were separated by cutting at cemento-enamel junction. Using acrylic resin, they were mounted

exposing the labial surface.

Bleaching protocol

The bleaching solution contains 1 ml of Pineapple/ Papaya extract + 1 ml of phosphate buffered solution + 28 ml of hydrogen peroxide. The teeth in group 1 were bleached with hydrogen peroxide, group 2 were bleached in combination with pineapple extract, and group 3 in combination with papaya extract. The specimens were immersed in solutions for 20 min and 10 min from subgroup A and B, respectively. The teeth were rinsed and stored in artificial saliva at 37°C for 24 h after bleaching.

Testing methodology

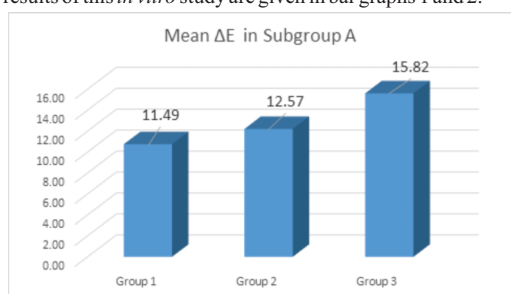
The testing was done with reflectance spectrophotometer over a white background, which recorded color variables L*, a*, b* in accordance to CIEL*a*b color system using a formula:
 $\Delta E = ([\Delta L^*]^2 + [\Delta a^*]^2 + [\Delta b^*]^2)^{1/2}$

STATISTICAL ANALYSIS:

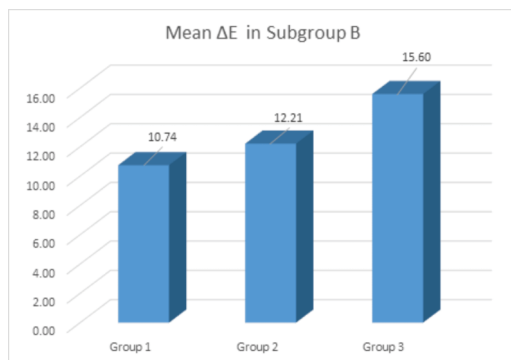
The results were statistically analysed using using Kruskal Wallis test.

RESULTS:

The results of this *in vitro* study are given in bar graphs 1 and 2.



Bar graph 1. Depicting mean ΔE in subgroup A for all 3 Groups



Bar graph 2. Depicting mean ΔE in subgroup B for all 3 Groups

The mean ΔE values of Group 1A (11.49), Group 2A (12.57), and Group 3A (15.82) showed higher values when compared to the mean ΔE values of Group 1B (10.74), Group 2B (12.21), and Group 3B (15.60) as shown in Table 1.

Table 1. Shows mean ΔE values of all the groups

	20 MINUTES (A)	10 MINUTES (B)
GROUP 1	11.49	10.74
GROUP 2	12.57	12.21
GROUP 3	15.82	15.60

DISCUSSION:

Managing discolored dentition is a common procedure in day to day practice. Teeth discoloration can either be intrinsic or extrinsic. The management protocol basically depends on the etiology starting from the most conservative procedure like bleaching to extensive full coverage veneer.⁷

Commercially available bleaching agents contain a wide spectrum of the concentration of hydrogen peroxide or its precursor Carbamide peroxide.⁸ Side effects would include the injuries to the hard and soft tissues of the oral cavity, surface roughness, postoperative sensitivity and irritation or burns to the soft tissues in the oral cavity.⁸

The use of enzymes has been proposed as a viable alternative for bleaching.⁶

In this study the vegetative enzyme extracted from Pineapple & Papaya were used for bleaching. Pineapple contains Bromelain, catalase, and polyphenol peroxidase. The pH of extract was 3 to 6.5; in this pH, the components of the extract are stable. At this pH, the extract causes disruption of adhered proteins causing stains.⁹ Papaya contains enzyme Papain-sulphydryl protease consisting of single polypeptide chain. This enzyme is able to hydrolyse the peptide bonds. It can be used as a non-abrasive whitening agent.¹⁰

Colorimeter is an alternative mode to evaluate the change in colors. It is not able to detect color in the curved surface like tooth structure. Spectrophotometer demonstrates the high level of accuracy and reproducibility. The color change values obtained from the spectrophotometer were analyzed on the basis of CIE values.¹¹

CONCLUSION:

Within the limitation of this study Pineapple & Papaya extract when used as a bleaching agent resulted in significant colour change on stained enamel. It can be concluded that natural enzymes along with hydrogen peroxide are more effective when compared to 30% hydrogen peroxide alone.

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