Research Article

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Effect of Vital Bleaching with Hydrogen Peroxide and Carbamide Peroxide with and without Additive of Pineapple Extract

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ABSTRACT

Background: To evaluate the colour change in human enamel bleached with hydrogen peroxide and carbamide peroxide with and without natural extract of pineapple using colorimeter.

Materials and Methods: 40 incisors were taken and artificially stained. After that baseline colour value was obtained. The specimen was divided into four groups of 10 teeth each. Group 1: 35% Hydrogen peroxide, Group 2: 35% Hydrogen peroxide with natural pineapple extract, Group 3: 37% carbamide peroxide, Group 4: 37% carbamide peroxide with natural pineapple extract. One half of the tooth was bleached with hydrogen peroxide / carbamide peroxide and other half was bleached with same bleaching agent with natural pineapple extract. Statistical analysis was performed using Student's t-test.

Result: The mean value of Group 2 showed a statistically significant higher value when compare to mean value of other groups.

Conclusion: Pineapple extract added to hydrogen peroxide gives effective results in bleaching.

Keywords: Bromelain enzyme; colorimeter; hydrogen peroxide; pineapple extract; tooth bleaching.

INTRODUCTION

The desire to have white teeth and thus a more pleasant smile has become an important esthetics need of patients today.[1] Tooth discoloration may have a significant esthetics and social impact.[2] A large number of people seeking dental treatment are concerned about the appearance of dentition and colour of teeth, in particular for cosmetics. Treatment of tooth staining and discoloration has been a recent increase as shown by the large number of tooth whitening agents appearing in the market.[3]

Including tooth colour, aesthetics of dentition is of teeth great importance to patients, including tooth colour. Teeth colour is a combination of intrinsic colour of teeth and combination of extrinsic stains that might accumulate on the tooth surface· extrinsic stained are linked with the adsorption of material into the acquired pellicle on the enamel surface·[4]

Two types of bleaching systems are generally employed. To enable careful monitoring, the strongest bleaching systems are only applied in the

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dental office. At-home bleaching systems use carbamide peroxide or hydrogen peroxide as the active ingredient.[5]

These procedures would include from bleaching to extensive restorations, where bleaching is a simpler conservative modality of treatment for the management of discoloured teeth. Hence, vital bleaching has gained a lot of popularity.[2]

In aesthetic dentistry, since 1989 vital bleaching has been used as an adjunct to tooth whitening hydrogen peroxide and carbamide peroxide are recent material used for vital bleaching. Both peroxides generate free radicals, reactive oxygen molecules and hydrogen peroxide anions. These reactive elements diffuse into tooth enamel and dentin and react with long-chained chromophores splitting them into smaller less coloured and more diffusible molecules.[6]

Therefore, the aim of this *in vitro* study was to evaluate the colour change in human enamel bleached with hydrogen peroxide and carbamide peroxide with and without natural extract of pineapple using colorimeter.

MATERIAL AND METHODOLOGY

Specimen Collection

For this study, 40 maxillary central incisors which were extracted due to periodontal disease were collected. The teeth were later checked for visible cracks, caries and defects. The defective teeth were removed. Later, the teeth were cleaned of calculus and the remaining soft tissue using an ultrasonic scaler. They were stored in saline at room temperature.

Preparation of Pineapple Extract

200 grams of Pineapple were peeled and cut into small pieces. The pieces were smashed and blended in blender with 25 ml of distilled water. The obtained filtrate was centrifuged at 2000 rpm for 2 minutes. The clear liquid was filtered out and refrigerated at 4°C until further use.

Preparation of staining material

Artificial staining protocol used for the study was strictly followed as stated by Sulieman *et al.*[14] Tea bag (2gm) was placed in 100 ml of boiling hot water. After 5 min, the solution was cooled to room temperature, tea bag was removed and it was ready to use for staining

Staining of Specimen

Staining was achieved by immersing the teeth for 24h in staining solution. Later, the teeth were washed with running tap water and stored in glass beaker at 37°C in incubator. To establish the baseline color values, 40 selected stained specimens were measured in colorimeter.

The teeth were randomly divided into four groups of 10 teeth each as follows:

Group 1 (n = 10) –35% Hydrogen peroxide
Group 2 (n = 10) – 35% Hydrogen peroxide with pineapple extract
Group 3 (n = 10) – 37% Carbamide peroxide
Group 4 (n = 10) – 37% Carbamide peroxide with Pineapple extract

Teeth were decoronated at cementoenamel junction using Dimond disc under copious water spray. The crowns were sectioned longitudinally to equal mesial and distal halves, then they were mounted in dental wax of 2×2cm dimension exposing the labial surface.

Bleaching Protocol

The bleaching solution contained 2 ml of pineapple extract and 28ml of hydrogen peroxide. They were proportioned and mixed in a test tube. One half of the tooth was bleached with hydrogen peroxide while the other half of the same tooth was bleached with a combination of hydrogen peroxide and pineapple extract. The specimens in each group were immersed in experimental solutions for 20 min. After bleaching, the teeth were rinsed and stored in artificial saliva at 37°C for 24 h. Same protocol was applied for carbamide peroxide.

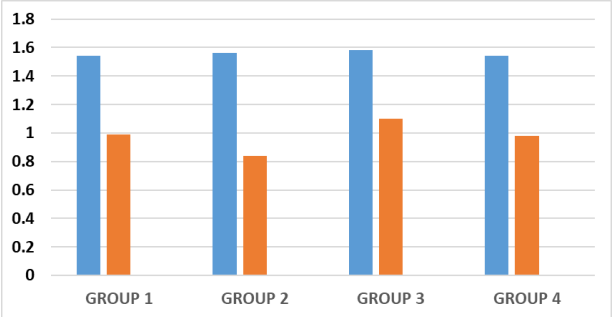
The testing was done with colorimeter which recorded a colour value before and after bleaching. The test for significance of before and after bleaching was analysed using Student's t-test at 5% significance level.

RESULT

The result of this in vitro study was given in Table 1&2

Table 1: Baseline and experimental value of different group.

Groups	Baseline colour value (Mean value)	After bleaching (Mean value)
Group-1 (Hydrogen peroxide group)	1.54	0.99
Group-2 (Hydrogen peroxide + pineapple extract)	1.57	0.84
Group-3 (carbamide peroxide)	1.56	1.1
Group-4 (carbamide peroxide + pineapple extract)	1.58	0.98



Graph 1: Graph showing Baseline and experimental value of different group.

In all the groups evaluated in the study, the mean values obtained in group 2 and group 4 showed statistically significant whitening when compared to the group 1 and group 3 specimens that were bleached only with hydrogen peroxide and carbamide peroxide ($P < 0.05$)

Comparing within the groups, the mean values obtained with pineapple extract showed statistically significant values ($P > 0.05$). When comparing among the group of hydrogen peroxide and carbamide peroxide alone, the colour change was significantly lower. ($P < 0.05$).The results clearly indicate the significant role of vegetative enzymes in improving the efficacy of hydrogen peroxide at lower concentrations.

DISCUSSION

Management of discoloured dentition has become a common procedure in our day-to-day practice. Discoloration of teeth can be either intrinsic or extrinsic.[1] The management protocol of these discolorations would depend on the etiology starting from the most conservative procedure – bleaching to extensive full coverage veneer. Sometimes, patients do seek treatment just to whiten the teeth, for which bleaching becomes the primary mode of treatment.[7]

Lot of agents and techniques are available for bleaching, but all of them involve directly or indirectly hydrogen peroxide.[8]The pure form of hydrogen peroxide is colorless and it is a potent oxidizing agent. Hydrogen peroxide cleaves the organic color ring molecules and makes them colourless by a simple oxidizing procedure, thus resulting in lightening of the tooth color.[9]

Hydrogen peroxide readily decomposes when it encounters substances with which it can react and results in the release of free radicals. If the bleaching procedure is continued beyond the saturation point, in the course of decomposition, hydrogen peroxide also interacts with the organic components of the tooth, such as proteins and lipids, resulting in their removal. This makes the surface rough. Hydrogen peroxide also dissolves the inorganic components of enamel by penetrating the intra and interprismatic regions. An increased exposure to hydrogen peroxide leads to an increase in its penetration into the enamel. This leads to a deepening of the grooves in an already roughened enamel surface.[5]

It is obvious that higher concentration of hydrogen peroxide is always be tagged with its own side effects. The side effects would include the injuries to the hard and soft tissues of the oral cavity.[7] Hydrogen peroxide also has the potential to penetrate deep into the dentine surface thus causing postoperative sensitivity. In addition, hydrogen peroxide causes irritation or burns to the soft tissues in the oral cavity. Hence, there is always a quest to find alternatives to hydrogen peroxide. The results of various studies in the field of food

chemistry have shown that certain vegetative enzymes have a good antioxidant effect. The use of these enzymes along with hydrogen peroxide has been proposed as a viable alternative for bleaching. Hence, this *in vitro* investigation was taken up to evaluate the efficacy of use of vegetative enzymes along with hydrogen peroxide for bleaching human enamel.[10]

In this study, vegetative enzyme extracted from pineapple was used. Pineapple contains bromelain, catalase, and polyphenol peroxidase. The pH of the extract ranges from 3 to 6.5.At this pH, the components of the extract are stable. The extract obtained from pineapple causes disruption of adhered proteins causing stains. Bromelain present in this extract acts as a predominant oxidizing agent. These enzymes are carefully extracted from pineapple by the protocols established earlier. The results were evaluated using a colorimeter[11]

The conversion of colorimetric measures to color parameters involves a specification of both the illuminant and the observer that was used in the conversion and should be included with the resultant colour parameters. it has been established that colorimeter demonstrates high level of accuracy and reproducibility. The color change values obtained from the colorimeter were analysed.[12]

The results obtained from the groups which used pineapple extract. along with hydrogen peroxide showed significantly higher lightening of tooth color when compared with group with only hydrogen peroxide and carbamide peroxide. In addition, when comparing the mean values within the groups, it was found that the values were statistically nonsignificant.[13]

The results obtained in the study can be directly attributed to the role of enzyme extracts obtained from pineapple. The proteolytic enzyme bromelain has played a major role in bleaching process, by removing or disrupting the protein portion of the pellicle layer adhered to the tooth surface. The role of bromelain has been well established by the food chemistry research. The enzymes added to the experimental bleaching solution reduced the activation energy of hydrogen peroxide (75 kj/mol) at the same time increased the rate of release of free radicals.[14] Vekaash et al in concluded that effective bleaching is achieved by addition of pineapple extract to hydrogen peroxide. [15] This result is similar to that of our study.

CONCLUSION

Within the limitations of this study, hydrogen peroxide along with pineapple extract as a bleaching agent resulted in significant colour change on stained human enamel when compared to the use of hydrogen peroxide and carbamide peroxide without any additives.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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