International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 8; Issue 10 (D); October 2019; Page No.20285-20288
DOI: http://dx.doi.org/10.24327/ijcar.2019.20288.3958

Research Article

EFFECT OF VITAL BLEACHING WITH SOLUTIONS CONTAINING 35% HYDROGEN PEROXIDE ALONE AND IN COMBINATION WITH PINEAPPLE EXTRACT , APPLE CIDAR VINEGAR, LEMON + BAKING SODA ON SURFACE ROUGHNESS OF HUMAN ENAMEL: AN ATOMIC FORCE MICROSCOPIC STUDY

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A R T I C L E I N F O

Article History:
Received 13th July, 2019
Received in revised form 11th August, 2019
Accepted 8th September, 2019
Published online 28th October, 2019

Key words:

Renal oxidative stress - Potassium bromate-ALA- quinoa seeds -Rats.

A B S T R A C T

In recent years, a quinoa seed has sparked much interest as a healthy natural cereal. In present study aimed to clear effect of quinoa at (2, 5 and 10%) against potassium bromate in rats. Thirty male rats were divided into six groups. The first group fed on basal diet. The other treated five groups injected with potassium bromate and reclassified into positive control, group treated with ALA and three groups treated with quinoa seeds at concentrations (2, 5 and 10%).

The results showed that, (+ve) group had significant decrease in final weight, weight gain, feed efficiency ratio (FER), protein efficiency ratio(PER), (HB), (PCV), plasma glutathione transferase(GST), plasma catalase, plasma superoxide dismutase(SOD), kidney SOD, kidney glutathione peroxidase (GPX), and kidney GST but significant increase in serum (AST&ALT) enzymes, alkaline phoshatase(AP), creatinine, uric acid, nitric oxide(NO) and kidney (MDA) compared to (-ve) group. quinoa seeds groups showed significant decrease in PCV, plasma GST, kidney GPX and GST.

ALA group decrease in serum uric acid compared to (-ve) while quinoa seeds groups showed significant increase in serum uric acid compared to (-ve). On the other side , they increased significantly in final weight, weight gain, FER, HB, plasma (GST, SOD &catalase) and kidney (SOD, GPX and GST) but showed significant decrease in serum AST, ALT &AP enzymes, creatinine, uric acid, NO and kidney MDA compared to (+ve) group.

INTRODUCTION

Numerous chemical methods have been recommended for the improvement of the appearance of discolored teeth. One of the most effective tooth bleaching agents is the hydrogen peroxide, whose application in dentistry was described by Harlan as early as 1884 [1]. Dental discolorations are classified as extrinsic and intrinsic, and extrinsic stains are divided into three types according to Nathoo [2]. During the past decade, tooth bleaching has undergone great development. Use of the so-called ‘‘in-office’’ tooth bleaching technique has decreased. This technique requires the use of 30–35% hydrogen peroxide and also direct monitoring by the dentist. The so-called ‘‘at-home’’ nightguard vital tooth bleaching has come into the focus of both the dentist’s and the patient’s interest. This method was first described and published by Haywood and Heymann [3], and this technique uses 10 to 15% carbamide peroxide in a custom-made mouthguard for several weeks.

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According to a Clinical Research Associates (CRA) survey, 62% of the dentists prescribe at-home carbamide peroxide bleaching [4]. Although research has examined the effects of bleaching agents on tooth hard tissues, the exact mechanism is unknown [5]. It is supposed that peroxide-containing bleaching agents remove tooth discolorations through oxidation [6]. Oxidation alters the chemical structure and, consequently, the color of the chromogens. It is not known as to what kind of reactions occur between the peroxide and the enamel or the dentin. Although dental hard tissues are highly mineralized, their organic content can play an important role in the bleaching process. Mature enamel has only approximately 0.6% organic matter content by weight [7]. This organic matrix is primarily composed of proteins and lipids [8]. Recent evidence indicates that some organic material of the enamel (e.g. albumin) originates from exogenous sources and becomes part of the organic matrix [8]. Exogenous organic materials can probably be found only in the outer enamel structure, as hydroxyapatite crystals in enamel are packed closely in a set orientation that interferes with the penetration of high molecular weight exogenous proteins into the deeper layers [8]. The presence of this organic material requires an

examination that is performed in natural conditions. In the past decade, numerous studies evaluated the effects of peroxide-containing bleaching agents on tooth hard tissues. Most of the studies found insignificant alterations of the enamel surface. Ernst *et al*. [9] evaluated four bleaching agents using scanning electron microscopy (SEM). They found that enamel underwent slight morphological alteration after bleaching. Another study by Murchison *et al*. [10] demonstrated that short-term regimens of carbamide peroxide did not significantly affect the hardness of the enamel surface. An investigation into the effect of bleaching on tooth hard tissues found insignificant volume loss in enamel after 8 weeks [11]. Tong *et al*. [12] found that 30% hydrogen peroxide treatment with a bleaching light for 30 min caused no measurable loss in the enamel. However, other studies described significant changes of the enamel including increased porosity, non-uniform changes and the morphological alteration of the enamel surface [6,13]. Most of the investigators evaluating the effects of bleaching agents on the surface of tooth hard tissues, mainly on enamel, used SEM. This method requires special specimen preparations and examination conditions. Specimens for SEM must be dehydrated, and are coated with a conductive material, e.g. gold–palladium in the majority of the cases. These procedures change the natural conditions and/or part of the specimen structure. In the present study, atomic force microscopy (AFM) was chosen to rule out these problems. AFM is capable of giving images with atomic resolution. Although we did make use of this resolution capacity in our study, AFM has other advantages: (1) it requires minimal sample preparation; (2) it is capable of detecting the surface not only along the X and Y axes, but also along the Z axis; (3) because examination conditions using AFM are much closer to the natural ones than those of SEM, the surface morphology represented in an AFM image is more likely to represent the natural conditions.

Therefore the aim of this study was to check the surface roughness on enamel after application of 35% hydrogen peroxide alone and in combination with pineapple extract, apple cidar vinegar, lemon + baking soda.

MATERIAL AND METHODOLOGY

Specimen collection For this in vitro study, 40 maxillary central incisors that were extracted due to periodontal disease were collected. The teeth were later examined for visible cracks, caries defects, and decalcifications. The defective teeth were discarded. Later, the teeth were cleaned of calculus and the remaining soft tissue using an ultrasonic scaler (Satelec, India). They were stored in 0.2% thymol, refrigerated at 4°C until use. Later the teeth were divided into 4 groups, based on the bleaching agent used.

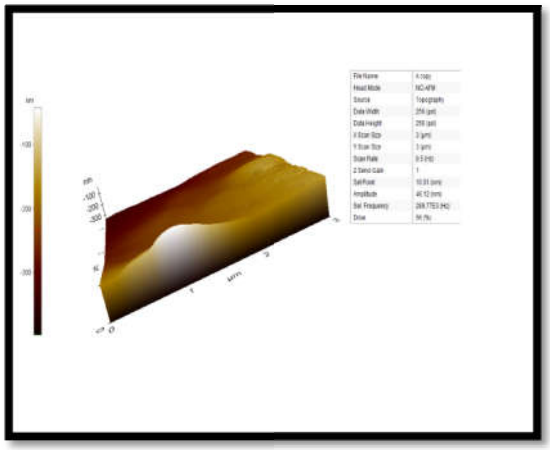
Group A: Lemon + baking soda +35% H2O2
Group B: Pineapple + 35% H2O2
Group C: Apple cider vinegar + 35% H2O2
Group D:35% hydrogen peroxide

Preparation of pineapple extract Two hundred grams of pineapple (Ananas comosus) 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 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.

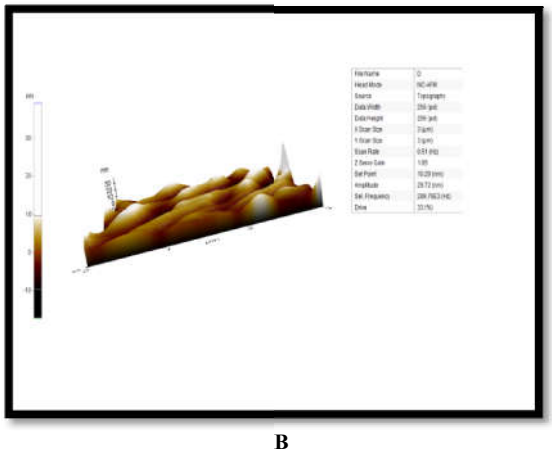
Then the teeth were cut at cementoenamel junction, cut surface of crown was sealed with GIC. Once the GIC was set the samples were mounted on acrylic resin such that the labial surface was faced upwards. Labial surface painted with bleaching solution kept it for 10 min, this procedure was followed for all the groups. After 10min the samples were taken out of the solution and were sent for observation under AFM.

Atomic force microscope

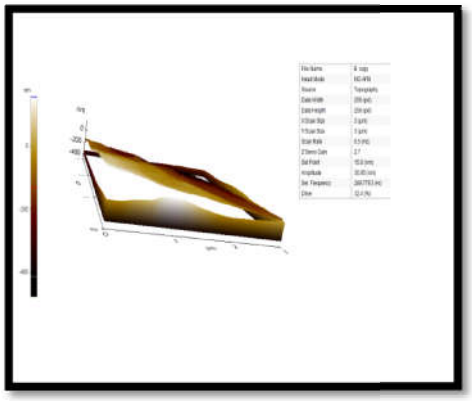
3 D scanning images were obtained



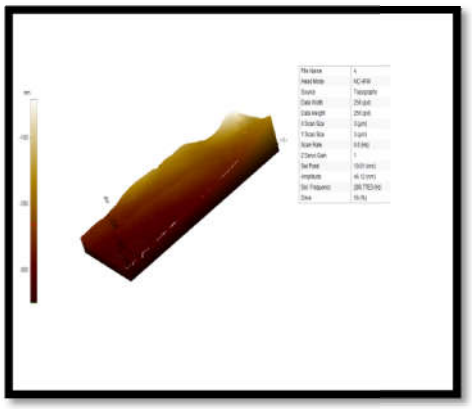
A



B



C



D

Statistical analysis

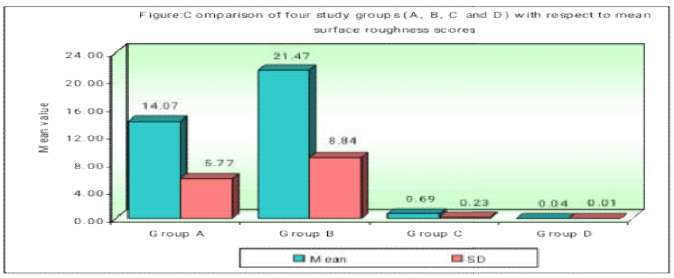
Normality of surface roughness scores in four study groups (A, B, C and D) by Kolmogorov Smirnov test

Groups	Z-value	p-value
Group A	0.7610	0.6090
Group B	0.7530	0.6220
Group C	0.4420	0.9900
Group D	0.3420	0.9999

The surface roughness scores in four study groups (A, B, C and D) follows a normal distribution, therefore, the parametric one way ANOVA and Tukeys posthoc procedures were applied

Groups	N	Min	Max	Mean	SD	SE
Group A	10	8.75	26.68	14.07	5.77	1.82
Group B	10	0.63	29.69	21.47	8.84	2.80
Group C	10	0.42	1.14	0.69	0.23	0.07
Group D	10	0.02	0.07	0.04	0.01	0.0001

Comparison of four study groups (A, B, C and D) with respect to mean surface roughness scores



RESULT

Even though Pineapple extract in combination with 35% H2O2 shows good color stability but the surface roughness is more as compared to other group.

DISCUSSION

Management of discolored dentition has become a common procedure in our day-to-day practice. Discoloration of teeth can be either intrinsic or extrinsic. 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.[1,2]

Lot of agents and techniques are available for bleaching, but all of them involve directly or indirectly hydrogen peroxide. 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 colorless by a simple oxidizing procedure, thus resulting in lightening of the tooth color.[3,10,11]

Commercially available bleaching agents contain a wide spectrum of the concentration of hydrogen peroxide or its precursor carbamide peroxide to suit individual clinical needs. 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.[11] Hydrogen peroxide at a microscopic level causes surfaces roughness due to its action and on prolonged exposure would also destroy the organic component by disrupting the intraprismatic and interprismatic enamel.[5,12,22] 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.[13] 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.[8] 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.

According to the results obtained from the study it is seen that minimum surface roughness was observed in group D i.e. in only hydrogen peroxide group but colour stability was not improved. Followed by group C Apple cider vinegar + 35% H2O2, third was group A Lemon + baking soda +35% H2O2 while most colour stability was seen for the group B Pineapple + 35% H2O2 but surface roughness was most than compared to all other groups.

In an study published in journal of conservative dentistry shows that addition of sweet potato extract to hydrogen peroxide not only resulted in the restoration of the natural tooth color, but also decreased the effects of bleaching on the enamel morphology.

Limitation of Study

Addition of hydrogen peroxide with various agents may increase color stability but chemical reactions between them is not yet studied.

CONCLUSION

Within the limitations of this study,35 % hydrogen peroxide along with pineapple extract as a bleaching agent resulted in significant color change but the surface roughness is more on stained human enamel when compared to other groups.

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How to cite this article:

Kiran Wanve *et al* (2019) 'Effect of Vital Bleaching with Solutions Containing 35% Hydrogen Peroxide Alone and in Combination with Pineapple Extract , Apple Cidar Vinegar, Lemon + Baking Soda on Surface Roughness of Human Enamel: an Atomic Force Microscopic Study', *International Journal of Current Advanced Research,* 08(10), pp. 20285-20288.
DOI: http://dx.doi.org/10.24327/ijcar.2019. 20288.3958

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