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Effects of Tooth Whitening Agents in Non Vital Teeth

Harshitha C

BDS student, Saveetha Dental College, Chennai, India.

Abstract

Discoloration of the teeth is often percieved as an aesthetic detraction. Because of this, the treatment for discoloration of non vital teeth has become increasingly important.Tooth whitening can be achieved by various methods and various chemicals. Each chemical has its own action, efficiency and effects on the dental tissue. In this review of literature, the effectiveness and effect of various concentration of tooth whitening agents on non vital teeth have been discussed. It has been noted that cervical resorption of root is one of the most common and important risk in the whitening of non vital teeth.

Key Words

Tooth whitening agents, hydrogen peroxide, cervical root resorption, bleaching, non-vital teeth

INTRODUCTION

Tooth whitening is of great importance in dental aesthetics. Whitening may be visually perceived and measured within a few days or weeks, depending on the technique used for peroxide delivery and retension, and the method of assessment(1). Tooth bleaching can be performed externally, termed vital tooth bleaching, or intracoronally in root-filled tooth, called non-vital tooth bleaching. The bleaching of non vital teeth is relatively low risk treatment for improving the esthetics of endodontically treated teeth.(8) was first mentioned by Garretson in 1895, who used chlorine as the bleaching agent(6). In discoloured non vital teeth, the intracoronal bleaching procedure is widely used because it is efficient, relatively simple, presents low cost and preserves the dental hard tissue compared to the prosthetic treatment(2). The intracoronal bleaching agents most commonly used are hydrogen peroxide, carbamide peroxide and sodium perborate(3)(4)(5).

In this article, we are going to discuss about the effects of various tooth whitening agents like hydrogen peroxide, carbamide peroxide and sodium perborate in non vital teeth.

ACTION OF TOOTH WHITENING AGENTS

Tooth whitening systems are based primarily on hydrogen peroxide(H_2O_2) or one of its precursors, carbamide peroxide. These bleach the chromogens within the dentine, thereby reducing the body colour of the tooth and are often used in combination with an activating agent such as heat and/or light.(7).Discolouration arise due to the formation of chemically stable, chromogenic products. These pigments consist of long-chain organic molecules. In bleaching, the pigments are oxidized by hydrogen peroxide which acts as a strong oxidising agent through the formation of free radicals , reactive oxygen molecules, and hydrogen peroxide anions. These reactive molecule will attack the long-chained, dark-coloured chromophore molecule and split them into smaller, less colured, and more diffusible molecule. During bleaching, the long-chain organic molecules are transformed into carbon and water, and – together with nascent oxygen – are released.(8)(9)

While the exact nature of the chromophores is unknown, when applied directly to the tooth surfaces, peroxide diffuses to the chromophores within the structure of the tooth(10),

many coloured species contain carbon-carbon double bond with which hydrogen peroxide can react to form an achromatic species.(11). Studies done by Nathoo says that, the hydrogen peroxide metabolizes into water and free radicals of oxygen. These free radicals posses a single electron, which is thought to combine with the chromogens to decolourize or solubize them.(12)

EFFECTIVENESS OF VARIOUS TOOTH WHITENING AGENTS

Hydrogen peroxide (H2O2) is an effective bleaching agent. Nevertheless, high concentrations (30%) should only be used with caution, in order to avoid increasing the risk of root resorption (25). Sodium perborate occurs in the form of mono-, tri- (NaBO2 • H2O2 • 3H2O) or tetrahydrate. Upon adding water, H2O2 is released. The bleaching effect is not weakened if sodium perborate is mixed with water instead of hydrogen peroxide (26 & 20) .

Studies show that, sodium perborate in water, sodium perborate in 3% and 30% hydrogen peroxide, and 10% carbamide peroxide are all efficient at internal bleeching of non vital teeth.(18-20).Currently, there are very few studies on the use of sodium percarbonate (2Na2CO3 • H2O2),but this agent has been long ignored, as its stability during storage was very poor. An in vitro study found the bleaching effect of sodium percarbonate (mixed with water) to be similar to that of 30% hydrogen peroxide (27). However, clinical studies are still lacking. Carbamide peroxide (CH4N2O • H2O2) is an organic compound containing hydrogen peroxide and urea. In an in vitro test, carbamide peroxide showed a bleaching ability equal to that of hydrogen peroxide (28). Products which contain 10% carbamide peroxide release 3.5% hydrogen (29)

COMPARISON OF THE EFFECTIVENESS OF TOOTH WHITENING AGENTS

The efficacy of the different medicaments used for internal tooth bleaching has been evaluated in vitro on artificially stained teeth. After 14 days (30) and one year (26), there was no difference in the shade of the teeth bleached with sodium perborate in 30% hydrogen peroxide, sodium

perborate in 3% hydrogen peroxide, or sodium perborate in water. Thereby,similar results were found in a study with sodium perborate mixed with 30% hydrogen peroxide or water and evaluated after 7, 14, and 21 days of treatment (20).

The results with sodium perborate in 30% hydrogen peroxide (93% of the artificially stained and bleached teeth recovered their initial shade) were better than those obtained with sodium perborate in water (53% recovered) (31). The immediate results after intracoronal bleaching with 10% carbamide peroxide were better than those with sodium perborate in 30% hydrogen peroxide (32).

From the above study, J. E. Dahl concluded that sodium perborate in water, sodium perborate in 3% and 30% hydrogen peroxide, and 10% carbamide peroxide were efficient for internal bleaching of non-vital teeth. The conclusion is based on artificially stained teeth and that the clinical situation may give different results

ADVERSE EFFECTS OF TOOTH WHITENING AGENTS

One of the most important local adverse effect is the changes in enamel and dentin, in particlar the reduction of enamel microhardness.(13). It has been suggested that peroxide might cause a modification in chemistry of dental hard tissues, changing the composition between organic and inorganic components. Intra coronal bleaching with 30% hydrogen peroxide has been found to reduce the micro-hardness of dentin and enamel(14).

Rotstein et al. subjected human premolars to solutions of 30% hydrogen peroxide, 10% carbamide peroxide, sodium perborate, and three commercially prepared bleaching agents (utilizing 10-15% carbamide peroxide with pH ranges from 6.0 to 6.5). Results showed that most of the bleaching agents caused changes in the level of calcium, phosphorus, sulfur and potassium in the hard tissue. Alterations in the inorganic component of hydroxyapatite are the results of changes in calcium and phosphorus ratio found within the hydroxyapatite crystals of dental hard tissues. The decrease was more significant in cementum and dentin tham in enamel. This was due to the differences between the organic and inorganic matter of the tooth. It was concluded that the bleaching materials may adversely affect the dental hard tissue. (24). Cervical root resorption is an inflammatory-mediated external resorption of the root, which can be seen after trauma and following intracoronal bleaching(15). Therefore a high concentration of hydrogen peroxide in combination with heating seemed to promote cervical root resorption.(16). Studies in Ausralia, in which bleaching was performed with 30% hydrogen peroxide and heat application, found that 2% of all teeth followed up exhibited cervical resorptions. In all cases of resorption, a prior tooth trauma had occurred.(21). It was shown that orthodontic treatment is responsible for the majority of cervical resorption (24.1%), with tooth trauma being the second most common predisposing factor for cervical resorptions (15.1%) (22). Defects at the cementoenamel junction increase the penetration of bleaching agent into the periodontal spaces.(23).Tooth crown fracture has also been observed after intra-coronal bleaching, most propably due to extensive removal of the intracoronal dentin.(17)

However the conclusions of few authors show that the bleaching technique with sodium perborate and water has no significant side effects.(33)

Some of the commercially available products which are effective in whitening the tooth are Idol White, Alta White, Bella Teeth Whitening, Whiteness Perfect, Whiteness Super, and Whiteness HP.

CONCLUSION

Sodium perborate mixed with water is considered as the best method to bleach non-vital teeth as it gives good result with very minimal/no adverse effect. However bleaching with other agents like hydrogen peroxide or its precursor can cause adverse effects such as cervical resorption of root. Dentist who performs these procedures should be aware of all the complications that can arise and should discuss the pros and cons of tooth whitening with the patients before undertaking the procedure.

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