"In Vitro Study to Evaluate the Effect of Two Bleaching Techniques on Color Stability of Laminate Veneer of Two Dental Ceramic Materials"

Thesis

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Ayat Ahmed Awad Elbadry

Dedication

This work is dedicated to my parents, sisters, husband and lovely son for believing in me and for their endless love and support.

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Introduction

Aesthetics is the science of beauty that particular detail of an animate or inanimate object that makes appealing to the eye [1]. Patient who have tooth discoloration, tooth misalignment or even those ask for brighter teeth can be treated by various restorative technique such as direct and indirect composite veneer, all ceramic restoration or bleaching.[2]

Dental ceramic materials are the esthetic material of choice for most clinicians because of their excellent biocompatibility, strength and surface texture and their overall esthetic properties.[3] Currently a wide variety of all ceramic dental restorations are provided using various ceramics systems.[4]

Laminate veneer restorations combines stable aesthetic and functional corrections of teeth with a low destructive technique and it can provide biocompatibility, color and contour stability with minimal risk of gingival irritation. [5,6]

Teeth's bleaching is one of the effective, comparatively safe, aesthetic treatments in dentistry and its techniques are based on the direct use of hydrogen peroxide or carbamide peroxide.[7] Tooth bleaching occurs through an oxidation-reduction reaction where the oxidizing agent as hydrogen peroxide has free radicals with unpaired electrons, which it gives up, becoming reduced and the reducing agent (the substance being bleached) accepts the electrons and becomes oxidized.[8]

The unstable free radicals and acidic PH that are generated from these compounds through either the oxidation or reduction reaction may

affect the properties of restorative materials as color, surface roughness and hardness especially when considering the fact that bleaching agent is held in intimate contact with dental restorations.[9,10]

The fact that over 40% of the population have at least one dental restoration so the interaction between the bleaching agents and esthetic restorative materials is very important and protection of restorations before any bleaching procedure is mandatory otherwise replacement of restoration will be necessary.[11,12]

Review of Literature

Esthetics has become an important issue in modern society because it seems to define one's character. In the past, functional demands were the main consideration in dental treatment but now with the decrease in caries prevalence, the focus has shifted toward dental esthetics.[13]

Smile look is amongst very important and impressive issues in esthetic that is affected by several different aspects such as tooth shape, texture, position and color. There are many factors that influence both the color and the brightness of the teeth. There are many approaches to improve tooth discoloration ranging from conservative procedures as teeth bleaching or laminate veneers to more invasive methods like full coverage restoration.[14]

Tooth Bleaching

Bleaching is whitening of discolored vital or non-vital teeth by oxidizing materials as hydrogen peroxide and carbamide peroxide and sodium perborate.[15]

Now bleaching is the most common esthetic treatment for adults because it has been shown to be an effective and noninvasive treatment when compared to other treatment modalities such as composite, veneer or full coverage crown. Indications for bleaching are uniform staining of teeth on the outermost surface of the enamel, mild fluorosis and mild extrinsic tooth discoloration.[16]

Historical development of the bleaching procedure

Historically in 1877 oxalic acid was used as bleaching agent. In 1884 Harlan hydrogen peroxide was used.[17] In 1916 the hydrochloric acid was used to treat mottled enamel. In 1937 mixture of hydrogen peroxide and ethyl ether was heated and applied for 30 minutes.

In 1966 hydrochloric acid with hydrogen peroxide was used for treating dental fluorosis.[13]

Nonvital bleaching was introduced firstly 1895 where chloride was applied to the tooth surface**.**[18] In 1958 a dentist packed hydrogen peroxide agent in the pulp chamber for 3 days. By the late 1960 pulp chamber was sealed with a mixture of 30% hydrogen peroxide and sodium perborate for up to a week.[19]

In 1972 a custom made night guard with 10% carbamide peroxide gel was used. In 1989 home bleaching materials were introduced in various forms firstly materials were in a liquid form but materials did not remain in the trays for long and needed more replenishment over time so gel form was introduced to stop the materials leaching out of the tray and causing soft tissue irritation. Later gel form developed to be in different vehicles and colors.[13]

Composition and mechanism of action

Bleaching materials contain hydrogen peroxide or carbamide peroxide thickening agent, urea, vehicle, surfactant, flavoring and preservative. The main component is hydrogen peroxide or carbamide peroxide.[20]

The differences between carbamide peroxide and hydrogen peroxide that carbamide peroxide is very unstable and when contact with tissue and saliva dissociating into hydrogen peroxide and urea then into oxygen, water and carbon dioxide.[19,21] A 10% carbamide peroxide solution contains 3.5% hydrogen peroxide and 6.5% urea. The other difference is that hydrogen peroxide releases all its peroxide in 30–60 minutes but carbamide peroxide releases 50% of its peroxide in the first two hours and the other 50% in 6 hours.[22]

The efficacy of the material depends on its concentration and duration of application.[23]. However, the efficacy of lower concentrations gets near the higher concentration when extending the treatment time.[24] Higher concentrations of hydrogen peroxide or carbamide peroxide shorten time at which the rate of tooth color changes to certain point after which the tooth color cannot change faster even with higher concentration.[13]

Hydrogen peroxide penetrate into enamel and dentin due to its low molecular weight.[25,26] Tooth bleaching occurs through an oxidation-reduction reaction where hydrogen peroxide decompose into free radicals with unpaired electrons, which are extremely electrophilic and unstable so they attack the unsaturated double bonds of chromophores, dye substance absorbed to the enamel surface and dentin tissue, and breakdown into smaller particles with lighter color "whitening effect".[13]

Types of bleaching

In-office bleaching

Different concentrations of hydrogen peroxide range from 25%to 40% used as in-office bleaching agent. Hydrogen peroxide gel is applied to the teeth after protection of the soft tissues by rubber dam or alternative then hydrogen peroxide is activated by heat or light as (halogen curing light, plasma arc, or Xe-halogen light, or Diode lasers or metal halide) for one hour. The in-office bleaching may need further appointment to obtain optimum result. In-office bleaching are recommended for bleaching of vital or nonvital teeth.[27]

Home bleaching

Low concentration of bleaching agent (10% to 20% carbamide peroxide) is applied to the teeth through a custom-made, vacuum-formed appliance and worn for at least 2 weeks**.** It is recommended that the 10% carbamide peroxide is used 8 hours use per day, and the 15%-20% carbamide peroxide for 3-4 hours used per day.[27]

Carrillo et al in 1998 [28] reported that the home bleaching can be used also for nonvital teeth. He prepared nonvital teeth, as in the walking bleaching, so the gutta-percha was sealed from the pulp chamber. The 10% carbamide peroxide was injected into the pulp chamber and loaded into the custom-fitted tray for all teeth. The patient closed the orifice with a cotton pellet during the day and changed the cotton pellet after the meals and applied fresh solution nightly. Carrillo found that the nonvital teeth were bleached from both the inside and outside and all teeth were successfully lightened.