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EC DENTAL SCIENCE
Review Article

Different Aspects of Teeth Whitening: Benefits and Drawbacks

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Received: October 28, 2019; **Published:**November 14, 2019

Abstract

Background: Tooth discoloration varies in etiology, appearance, localization, severity and adherence to tooth structure. It may be classified as intrinsic, extrinsic and a combination of both.

Aim of the Study: to highlight different aspects of teeth whitening and reveals some benefits and drawbacks.

Methodology: Data was collected from published articles in the last ten years. This was include papers published in PubMed and Google scholar index.

Conclusion: Although tooth whitening techniques are commonly used to treat discolored teeth, complete awareness to recognize different aspects of teeth whitening and reveals true benefits and suggested drawbacks is very essential for both dentist and patients.

Keywords: *Teeth Whitening; Benefits; Drawbacks; Morphological Changes; Photoactivators*

Introduction, Classifications and Hypersensitivity

A beautiful smile is everybody's desire nowadays. Not just perfect shapes and sizes that makes a smile look beautiful and healthy, but also the color. Tooth color reveals many things such as people's oral health, good and bad habits and their age. Everyone wants to look young and well maintained. Tooth whitening became one of the most wanted and performed cosmetic dentistry procedures. Although this type of treatment is safe and scientifically proven, some precautions must be taken, such as looking for a qualified professional. There are many whitening products available on the market. Each one was developed for specific scenarios, since each and every patient is different from another. Cosmetic dentistry has developed ways and techniques to change teeth color, making the treatment comfortable, predicable, painless and achieving long lasting results. The chemical substance used in this procedure consists of carbamide peroxide (CP) or hydrogen peroxide (HP). Both are presented as gel in different concentrations [1]. Basically, there are two whitening techniques scientifically supported [1]. We have the "in-office bleaching" and the "at home/overnight bleaching". The "in-office bleaching" is performed only by a dentist at the dental office and uses a high concentration hydrogen peroxide gel (35%), which may cause slight, moderate or even severe dental sensitivity during the procedure and post-operative and their long term result is still questionable [2]. And the "at home/

overnight bleaching" is a technique in which the patient applies the product inside a pre-fabricated silicone tray and fits it in his/her teeth. Depending on the CP or HP concentration, the treatment is performed overnight-gel concentration between 5% (HP) and 10% (CP)-or during the day-gel concentration between 15% and 21%, CP only [3]. The first step to begin any cosmetic/prosthetic procedures is dental bleaching. There are two different ways to follow up color shade changing along the treatment. The most used in day-by-day clinic is the shade guide. The other technique is using a spectrophotometer measurement, usually used in laboratorial experiments [2,4]. Tooth sensitivity during a bleaching treatment is classified in four stages, according to Marson:none, slight, moderate and severe. A condition can be considered normal when the patient feels none or slight sensitivity for a well succeed treatment [2]. When the sensitivity is moderate or severe, the treatment must be immediately suspended and the doctor must review what is happening. Root exposure, gingival retraction, dentin exposure, broken filling and even high concentration of the HP or CP used can be the responsible issue of the sensitivity.

Effect of bleaching on the pt psychology

Personal appearance is very important in society. Dentists are called upon to respond to requests from patients who wish to enhance their smiles [5]. The effect of a smile can be so significant that advertising experts refer to this phenomenon as "smile power" [6]. Social and psychological research has shown that appearance plays an important role in determining the quality of our interactions with others and is an important aspect of nonverbal communication. How people look can affect how they see themselves, what others think of them and how they attract others to them. By enhancing their appearance, people can change the impression they make on others. Physical attractiveness and self-evaluation have been positively correlated. Research has shown that throughout their lives attractive individuals have significant advantages over those perceived by society to be less attractive [6]. The influence of cosmetics in promoting psychological well- being and to the importance of self-perceived attractiveness is beginning to be recognized and understood in health care. Studies have shown that when increased attention is placed on appearance, patients' adjustments to illness and recuperation times are affected positively [7]. In dentistry, Jenny., *et al*. confirmed that dental esthetics impact on the perceived levels of self-confidence in assessments of personality characteristics [8]. Cosmetic dentistry appears to be emerging as a health service. Researchers agree that more investigation into psychological factors associated with appearance is needed.

Morphological changes of bleached tooth

Tooth whitening techniques are commonly used to treat discolored teeth. Most whitening products are based on hydrogen peroxide (HP), which exerts potent oxidizing action and gives rise to the formation of other very effective whitening agents, such as perhydroxyl anions (HO_2^-) and hydroxyl radicals (OH^-) [9]. The pH of the product, temperature, the activation procedure used, or the presence of certain transition metal elements all modify the type of reaction produced [10]. Carbamide peroxide (CP) in turn decomposes into HP and urea-the latter causing denaturalization of enamelin and amelogenin, which are proteins present in the matrix component found between the enamel prisms. This could increase enamel permeability and thus induce microstructural changes. On the contrary, urea induces alkalinization, which may result in reduced demineralization [9-11]. High concentrations of HP and CP are used as whitening agents in office, while HP concentrations of up to 6% (or the equivalent in the case of CP) can be applied, under professional supervision, at home [12]. Although HP is a potent and effective whitening agent, there is controversy regarding its safety and possible adverse effects [13]. In this regard, HP has been associated to morphological changes, as well as to variations in microhardness and in the mineral component of enamel and dentin, also changes in the dentin-enamel junction and in the elasticity and mechanical properties of dentin, as well as to alterations of their organic components. However, there are also many authors who have observed no relevant changes in enamel and dentin after such whitening treatment [14,15]. Many factors can condition such heterogeneous results, including parameters related to the substrate and the preparation and evaluation procedures involved, as well as the origin of the samples (human or bovine), age and the tooth preservation conditions involved. Regarding the sample preparation and observation procedures used for investigating the morphological changes, it is advisable to use techniques, such as environmental scanning electron microscopy (ESEM) or confocal laser scanning microscopy (CLSM), which do not require drying or other treatments, to avoid interferences with the results obtained [16,17].

Another factor that may account for the discrepancies in the published results is the pH of the product used. In this regard, some authors consider the pH of the product to be more important than HP concentration in conditioning the changes in morphology and roughness [18]. Regarding the concentration of the products, some authors have only described morphological changes or variations in the mineral component when using high concentration gels, while others have recorded changes even with products at low concentrations. In turn, some investigators have observed no changes when using HP at a concentration of 7.5% or CP at a concentration of 10 or 16% [19,20].

Causes of teeth discoloration

Tooth discoloration varies in etiology, appearance, localization, severity and adherence to tooth structure. It may be classified as intrinsic, extrinsic and a combination of both. Intrinsic discoloration is caused by incorporation of chroma-teogenic material into dentin and enamel during odonto-genesis or after eruption. Exposure to high levels of fluoride, tetra-cycline administration, inherited developmental disorders and trauma to the developing tooth may result in pre-eruptive discoloration. After eruption of the tooth, aging, pulp necrosis and iatrogenesis are the main causes of intrinsic discoloration. Coffee, tea, red wine, carrots, oranges and tobacco give rise to extrinsic stain [21]. Wear of the tooth structure, deposition of secondary dentin due to aging or as a consequence of pulp necrosis, or as a consequence of pulp inflammation and dentin sclerosis affect the light-transmitting properties of teeth, resulting in a gradual darkening of the teeth. Scaling and polishing of the teeth remove many extrinsic stains. For more stubborn extrinsic discoloration and Intrinsic stain, various bleaching techniques may be attempted. Tooth bleaching can be performed externally, termed night guard vital bleaching or vital tooth bleaching, or intra coronally in root-filled teeth, called non vital tooth bleaching.

Shade guide protocol

Today's dentist is acutely aware of the value of tooth bleaching to his or her practice and patients, but they want to provide treatment based on reliable evidence. The challenge for dentists is to determine the effectiveness of various tooth whitening systems, while keeping patients' safety paramount. This has become more and more difficult, as manufacturers continue to provide new products that purport to be superior to others currently on the market. Numerous claims are made based on higher concentrations of an active agent, the addition of desensitizing agents, better formulations or the use of lights or other innovations, although it is a well known fact that dental bleaching is primarily time and concentration dependent [22]. While many studies have been published detailing the effectiveness of various bleaching agents, there are only a few that have looked at both in office and at- home systems [23]. It is also very difficult to make valid comparisons between research accomplished at different sites using diverse instruments and techniques. Most published studies use the Vitapan classical Shade Guide (Vita Zahnfabrik, Bad Sackingen, Germany) for subjective evaluation, but it has not been demonstrated that the shade tabs are actually linear in color measurement [24]. The Trubyte Bioform Color Ordered Shade Guide is grouped according to the Munsell Color Notation (each tab identified by hue, chroma and value) and has a wider spectrum of shades, but this shade guide still cannot be interpreted as absolute. A new shade guide has recently been introduced with more equal color spaces and an extended tooth whitening range [25]. Several different color measuring instruments are being used for objective evaluation, but their values cannot currently be compared. In addition, the skill of the evaluator and lighting variables are other factors that need to be addressed and are challenging to control.

The American Dental Association (ADA) has recently revised its criteria for the Seal of Acceptance program with dentist prescribed at home, in office and over the counter products, certifying the safety and efficacy of those products to a certain measurable standard. Only one dentist prescribed at home product has been awarded the ADA Seal of Acceptance at this time. Even though the guidelines for ADA acceptance have recently been revised for the efficacy of products, the biological safety criteria have not been changed since they were established in 1994 [26].

(ADA) classification and advice for different bleaching methods

Over the past two decades, tooth whitening or bleaching has become one of the most popular esthetic dental treatments. Since the 1800s, the initial focus of dentists in this area was on in office bleaching of non vital teeth that had discolored as a result of trauma to

the tooth or from endodontic treatment. By the late 1980s, the field of tooth whitening dramatically changed with the development of dentist prescribed, home applied bleaching (tray bleaching) and other products and techniques for vital tooth bleaching that could be applied both in the dental office and at home. The tooth whitening market has evolved into four categories: professionally applied (in the dental office); dentist prescribed/dispensed (patient home use); consumer purchased/over-the-counter (OTC) (applied by patients); and other non dental options. Additionally, dentist dispensed bleaching materials are sometimes used at home after dental office bleaching to maintain or improve whitening results.

Consumer whitening products available today for home use include gels, rinses, chewing gums, toothpastes, paint on films and strips. The latest tooth whitening trend is the availability of whitening treatments or kits in non dental retail settings, such as mall kiosks, salons, spas and, more recently, aboard passenger cruise ships. Non dental whitening venues have come under scrutiny in several states and jurisdictions, resulting in actions to reserve the delivery of this service to dentists or appropriately supervised allied dental personnel. Current tooth bleaching materials are based primarily on either hydrogen peroxide or carbamide peroxide. Both may change the inherent color of the teeth, but have different considerations for safety and efficacy. In general, most in office and dentist prescribed, at-home bleaching techniques have been shown to be effective, although results may vary depending on such factors as type of stain, age of patient, concentration of the active agent, treatment time and frequency. However, concerns have remained about the long term safety of unsupervised bleaching procedures, due to abuse and possible undiagnosed or underlying oral health problems. Although published studies tend to suggest that bleaching is a relatively safe procedure, investigators continue to report adverse effects on hard tissue, soft tissue and restorative materials [27,28]. The rate of adverse events from use or abuse of home use OTC products is also unclear because consumers rarely report problems. Based on these factors, the American Dental Association (ADA) has advised patients to consult with their dentists to determine the most appropriate whitening treatment, particularly for those with tooth sensitivity, dental restorations, extremely dark stains and single dark teeth [29]. Additionally, a patient's tooth discoloration may be caused by a specific problem that either will not be affected by whitening agents and/or may be a sign of a disease or condition that requires dental therapy.

Effect of photo activators

Despite the large number of techniques described in the literature concerning the external bleaching of vital teeth, all are based on the direct use of hydrogen peroxide (H_2O_2) or its precursor, carbamide peroxide [29]. Minoux and Serfaty recognize that tooth-whitening is a very complex process that depends on several factors: (1) the pH of the bleaching agent, (2) the method of application and thickness of the bleaching agent to the enamel,(3) the fluctuation of irradiation, (4) length of photo activation, (5) tooth size, (6) selective absorption of the wavelength of irradiation, among others. Further studies are needed regarding the new wavelength of the laser lights and whitening products to determine the protocol and the most favorable terms in order to improve the process of tooth whitening [30,31]. To date, two techniques of tooth whitening have been described: 1) Ambulatory (at-home) that needs an intraoral device (tray) to apply the gel of peroxide, this one is more cost effective, the value of the dental color obtained is sustained for long periods; but important changes in this value are not observed before 7th day of the treatment; and 2) in office (by a professional) that uses photo-activation, this one allows changes in the color of the enamel from the first session, although there is strong evidence that the value of the dental color obtained is not sustained after 6 months [32]. Ameri confirmed on a study in Iran that the number of patients who wish to have tooth whitening treatment has increased by over 300% in the last 5 years; however, dentists often encounter the situation that patients prefer the office technique that involves photo activation. There is evidence that photo activation with Laser Light Emitting Diodes (LED) used on the in office technique just turned out to be more advantageous than ambulatory technique, when compared with halogen lamps and lasers, noticing that in the ambulatory technique, the changes in the value of dental color are not observed up to seven days of treatment. According to Sias and Abdul, the changes obtained in the value of the dental color through a home bleaching technique with 10% carbamide peroxide is held until two years after the procedure [33]. Some authors claim that in general, patients desire pearl white teeth, since tooth color is one of the most important determinants for patient satisfaction. White teeth have been linked to social competence, intellectual ability, successful interpersonal l relationships and even psychological stability. [34].

Summary of bleaching techniques

Aligned white and well contoured teeth are relevant to the majority of the population. This search for the (perfect smile) can be influenced by the media, by the professionals and among the patients themselves, reflecting as a synonym of health in the buccal cavity, besides the influence on the psychosocial state of the same ones [29]. The process of dental dimming occurs due to the formation of chemically stable structures, responsible for the progressive installation of spots on the dental crown. Knowledge of the etiology of dental blemishes by the dental surgeon is relevant to the choice of appropriate treatment [35]. Changes in tooth structure color may be due to extrinsic and intrinsic factors. The extrinsic stains usually come from the medium and are associated with dye pigments such as tobacco and coffee, the us e of certain types of medications and the accumulation of bacterial plaque, being surface stains and that leave more easily after prophylaxis. Since intrinsic stains can be congenital, related to dentino-genesis and imperfect amelo-genesis or can be acquired, from pulp necrosis, fluorosis, repairing dentin formation. Since 1861, Noavais and Toledo [36] reported that the first whitening. The Dental Cosmos Journal, in an article that stressed the importance of this theme in the New Haven Convention. Where he recommended the importance of knowing the chemical characteristics of the substances in question, mentioning sulfur dioxide and Labarraque liqueur (2.5% sodium hypochlorite) as bleaching agents.

Nowadays, the essence of the whitening technique still belongs to the one who used 30% hydrogen peroxide and heat in vitalized teeth and for the pulped teeth the sodium perborate associated with hydrogen peroxide at 30%. There are several bleaching techniques cited in the literature, with different types of substances such as carbamide peroxide and hydrogen peroxide in different concentrations. In addition to the variety of the bleaching substance, light sources such as allogeneic, laser, LED and ultraviolet can be used to potentiate the bleaching action [37]. Bleaching is a technique that increases dentin permeability, increasing dental sensitivity especially when there is an increase in temperature. The lower the heat generation of the whitening system, the lower the sensitivity. In this sense the new techniques of bleaching should evolve, in addition to decreasing the irradiance of the light that should activate photo-chemically the bleaching gel. The most common adverse effect associated with vital tooth whitening is tooth sensitivity. The incidence of hypersensitivity post bleaching is 10.0 to 90.0%, of mild or moderate intensity; however, it may become intense and result in discontinuation of treatment. The sensitivity is caused by the passage of the oxygen ion through the enamel and dentin, reaching the pulp tissues, which will result in sensitivity, being the treatment contraindicated for patients with dentin sensitivity [38].

In an attempt to neutralize dentin sensitivity, some manufacturers add potassium nitrate and fluoride to bleaching products, although it appears to result only in a limited reduction in the sensitivity experienced by patients. Low intensity laser therapies for desensitization have also been reported in the literature. Sensitivity to the tooth remains a major concern, although there are many studies and techniques that combine desensitizing approaches and bleaching substances and it is important to explore alternative desensitization regimes that are able to reduce or eliminate sensitivity and discomfort. In cases of non carious or incisal cervical lesions, dentinal exposure leads to dentin sensitivity during tooth whitening, which is why restoration of these lesions is indicated for treatment to be performed [39].

Concussion

Over the past two decades, tooth whitening or bleaching has become one of the most popular esthetic dental treatments. However, tooth whitening is a very complex process that depends on several factors. Success and failure of this process depends on knowledge and awareness for both the operator and the patient.

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