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Dental Bleaching Procedures and Their Effects: Review

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Abstract: **The purpose of this article was to review literature on tooth whitening, including side effects, safety concerns, and mechanism of tooth bleaching. A literature review was conducted using PubMed, Science Direct, and Google Scholar to search for studies concerning with "Dental Bleaching procedures and their effects" published up to November, 2017. Tooth bleaching is among the most conservative and cost-effective dental therapies to improve or enhance a person's smile. Nonetheless, tooth whitening is not safe and just limited long-term clinical information are offered on the side effects of tooth whitening. Accordingly, tooth whitening is best performed under specialist guidance and following a pre-treatment dental examination and diagnosis. In consultation with the patient, the most appropriate whitening therapy choice(s) might be selected and recommended based on the patient's lifestyle, financial considerations, and oral health. Finally, Clinicians should inform their patients regarding the feasible changes that might occur on their dental restorations during whitening procedure in addition to the possibility of replacement of the bleached restorations at the end of bleaching treatment.**

Keywords: **Dental Bleaching procedures, whitening therapy, Hydrogen peroxide (H2 O2).**

1. INTRODUCTION

Hydrogen peroxide (H2 O2) is discovered in the environment and the human body [1] and is utilized for industrial applications. For example, it is used in the making of foods and drinks like fruit juice, wine, and coffee [2].In the body, H2 O2 is an intermediate metabolite generated by the liver and phagocytic cells that is discovered in human serum or even in human breath. Although peroxide has been regarded safe and efficient in dental care as a tooth whitener for adults, a much smaller number of safety and efficiency researches have been conducted on children [3].For both kids and adults, there is a dearth of reports in the literature on systemic safety. Rather, the existing in vivo researches use animal designs. Of the studies on youngsters, the unfavorable effects investigated have been limited to the local results of tooth whitener usage [4].

On the other hand, a majority of pediatric patients are supposedly requesting tooth whitening recently [5].Sales of over-the-counter (OTC) tooth-whitening items grew 57% in 2003 [6].A 2004 literature search might not situate any kind of researches done to determine if teenagers overuse whiteners. The capacity for misuse, however, exists. One pediatric dentist that reported that even more of his adolescent patients complain of tooth sensitivity from tooth bleaching compared to his 7 to 11 year old patients who undertake the procedure theorized that teenagers could be using the residence whitening representatives extra frequently compared to directed to obtain faster outcomes [4].In one research, numerous youngsters- some as young as 10- wore their tooth whitener strips on the way to college in the early morning [5].On weekends, nonetheless, it is unidentified if these same kids wear these strips longer.

The purpose of this article was to review literature on tooth whitening, including side effects, safety concerns, and mechanism of tooth bleaching.

2. METHODOLOGY

A literature review was conducted using PubMed, Science Direct, and Google Scholar to search for studies concerning with "Dental Bleaching procedures and their effects" published up to November, 2017. searched included following terms; 'Dental Bleaching", "effectiveness". The reference lists from original and review articles were also reviewed to identify other relevant studies.

3. DISCUSSION

- **Mechanism of tooth bleaching:**

The system of bleaching by hydrogen peroxide is not well-understood. In-office and house bleaching gels contain hydrogen peroxide or its precursor, carbamideperoxide, as the active component in concentrations ranging from 3% to 40% of hydrogen peroxide matching. Hydrogen peroxide bleaching typically proceeds using the perhydroxyl anion (HO2 −). Various other problems could give rise to cost-free radical development, as an example, by homolytic bosom of either an O-H bond or the O-O bond in hydrogen peroxide to provide H + OOH and 2 OH (hydroxyl radical), respectively [7]Under photochemical responses started by light or lasers, the development of hydroxyl radicals from hydrogen peroxide has been shown to enhance [7]Hydrogen peroxide is an oxidizing representative that, as it diffuses into the tooth, dissociates to create unstable free radicals which are hydroxyl radicals (HO), perhydroxyl radicals (HOO), perhydroxyl anions (HOO-), and superoxide anions (OO-), which will strike organic pigmented molecules in the areas between the inorganic salts in tooth enamel by striking dual bonds of chromophore particles within tooth cells [8] The adjustment in double-bond conjugation causes smaller sized, less greatly pigmented constituents, and there will be a shift in the absorptionspectrum of chromophore molecules; thus, lightening of tooth tissues happens.

When it comes to tetracycline-stained teeth, the cause of discoloration is derived from photo-oxidation of tetracycline molecules readily available within the tooth structures [9].The whitening system in this situation happens by chemical deterioration of the unsaturated quinone-type frameworks found in tetracycline, bring about less colored molecules [10].Vital whitening via a long-term night guard could sometimes enhance the color of tetracycline-stained teeth [11].

Extra recently, amorphous calcium phosphate (ACP) has been added to several of the tooth lightening products, to decrease sensitivity, decrease the demineralization of enamel through a remineralization procedure after bleaching treatments, and add a lustrous shine to teeth. A research proved that the lightening treatments advertised increased sound enamel demineralization, while the addition of Ca ions or ACP did not prevent/reverse the effects brought on by the whitening therapy in both problems of the enamel. Early artificial caries caused by pH cycling design were not impacted by the lightening treatment, no matter the sort of bleaching agent [12].

- **Effects of the bleaching process:**

Effects on soft tissues:

The more effective in-office lightening (30-35% hydrogen peroxide) could easily produce soft-tissue burns, turning the tissue white [13].As a whole, these tissue burns are relatively easy to fix with no long-lasting effects if the exposure to the lightening product is limited in time and quantity. Rehydration and application of a disinfectant ointment promptly return the color to the tissue [14].For that reason, it is essential to protect soft tissues with a rubber dam or various other steps to prevent tissue burns. Furthermore, soft-tissue irritation has been reported with at-home whitening. This irritation is most likely as a result of an uncomfortable tray as opposed to the whitening agent itself [15].

Systemic effects:

There is even more problem concerning the feasible negative results of home-bleaching representatives, although their focus are far below those of in-office lightening agents, since the last are managed by the dentist. Periodically, patients report gastrointestinal mucosal irritation, e.g., a burning palate and throat, and minor upsets in the stomach or intestines [16].Nevertheless, a lot of records in the literary works have ended that using reduced focus of hydrogen peroxide in tooth bleaching is still safe [17].

Effects of dental bleaching on tooth structure:

There is still controversy over the effects of dental bleaching on the physical properties of enamel and dentin.

Effects on Enamel surface morphology and texture:

Many research studies in the literature have investigated the effects of bleaching on enamel morphology and the surface texture morphological modification of the enamel surface-- enhanced porosity of the superficial enamel framework, demineralization and decreased protein concentration, organic matrix degradation, adjustment in the calcium: phosphate ratio, and calcium loss-- thereby sustaining the theory that bleaching representatives are chemically active elements potentially able to generate considerable structural alterations in human dental enamel [18].Some studies have reported that whitening did not considerably influence the enamel surface area [19]. Nonetheless, other examinations demonstrated morphological modifications in the bleached enamel surface area: anxieties, porosity, and increased deepness of enamel grooves [18].

In a scanning electron microscopy (SEM) analysis, [20] reported no morphological adjustments in the enamel surface area after the application of 10% carbamideperoxide lightening. Titley et al. [22] observed a small increase in surface area roughness, whereas reported no modification of surface area roughness. In addition, [21] reported slight, unimportant, or no changes on enamel surfaces under 3000 × magnifying and making use of 30% solutions of hydrogen peroxide.

In contrast, various other researches have reported that dental whitening may cause morphological modification of enamel surface areas, such as increased porosity, superficial anxieties, and small erosion. Using atomic force microscopy, [23] observed modifications in the enamel surface area after 28 h of whitening with 10% carbamide peroxide and 30% hydrogen peroxide, and discovered that the example's surface area came to be extra irregular and surface area grooves ended up being deeper after bleaching treatment. Azrak et al. [24] conducted an in vitro research to evaluate the impacts of whitening representatives on worn down and sound enamel specimens. They used enamel samplings prepared from human permanent anterior teeth incubated with different whitening representatives including energetic ingredients such as 7.5% or 13.5% hydrogen peroxide or 35% carbamide peroxide, varying in pH from 4.9 to 10.8. To cause erosive changes, enamel specimens were incubated for 10 h with apple juice. Then, pretreated and untreated dental pieces were incubated with among the lightening agents for 10 h. An optical profilometric tool was utilized to measure surface area roughness of all enamel specimens. Results showed that exposure to an acidic lightening agent (pH = 4.9) caused a greater surface roughness compared to treatment with a high peroxide focus (pH = 6.15), and that bleaching agents with a high focus of peroxide or an acidic pH can prompt surface roughness of sound or deteriorated enamel. Furthermore, Josey et al. [25] taken a look at the effect of a night-guard vital bleaching procedure on enamel surface area morphology and the shear bond strength (SBS) of a composite resinluting cement to enamel. They used drawn out human teeth which were bleached for 1 week with an important whitening item. The results of this research study suggested that bleaching triggered adjustments to the surface and subsurface layers of enamel. However, the SBS of composite material luting cement to engraved bleached enamel appeared to be medically acceptable. Moreover, Bitter [26] conducted two studies, the initial of which examined the effects of bleaching representatives on the enamel surface area using SEM by comparison of treated with untreated enamel, and ended that the managed surface showed increased surface change and porosity after the equivalent of 30 h of exposure to the bleaching agent. The second study consisted of an in vivoexposure of bleaching agents used to assess the short- and long-term impacts on the enamel surface area; the results were shown by scanning electron microscopy [26]. Because study, he found that direct exposure to the bleaching agents for 14 days developed a modification of the enamel surface area and caused direct exposure of enamel prisms. In addition, a 21- to 90-day post-exposure SEM analysis showed a modification of the surface enamel, indicating a direct exposure of the enamel prismatic layer, frequently to the deepness of the enamel rods and potentially the dentin. Nevertheless, this research lacked sufficient controls, the patients' oral hygiene was not kept an eye on, and compliance might have been poor, given that the teeth were scheduled for extraction. Moreover, 35% carbamide peroxide lightening agent was utilized, which is not acceptable because it is taken into consideration to be expensive for lasting night-guard vital bleaching [26].

Effects on Enamel surface hardness and wear resistance:

Enamel surface hardness and wear resistance after dental bleaching have additionally been examined in the literature. Some researches showed no impacts, while others revealed considerable decreases in hardness and fracture resistance. Sasaki et al. [27] examined the result of home-use whitening agents consisting of 10% carbamide peroxide and 7.5% hydrogen peroxide on enamel microhardness and surface micromorphology. They ended that these whitening agents may alter the surface micromorphology of enamel, although no changes in microhardness were detected. Potočnik et al. [28] reviewed the effect of 10% carbamide peroxide on the human enamel subsurface layer in regards to microhardness, microstructure, and mineral material. They found that 10% carbamide peroxide triggered medically insignificant

neighborhood microstructural and chemical modifications in enamel. In contrast, Azer et al. [29] examined the nanohardness and elastic modulus of human enamel after treatment with tray and strip whitening systems. They exposed human enamel examples to 5 various lightening agents. Outcomes revealed that the nanohardness and flexible modulus of human enamel were considerably lowered after the application of home-bleaching systems.

Furthermore, Araujo Fde et al. [30] explored the effects of numerous light sources on the microhardness of human dental enamel complying with therapy with an in-office vital whitening representative (35% hydrogen peroxide) making use of enamel slabs subjected to hardness testing after four time periods (baseline and after 1, 7 and 14 days). Enamel slabs were after that separated into five teams according to the light source therapy: Group LA (35% hydrogen peroxide + argon laser system); Group HA (35% hydrogen peroxide + halogen light-curing device); Group LED (35% hydrogen peroxide + LED-laser unit); Group OX (35% hydrogen peroxide + no light source unit); and Group CO (control: saliva just). Outcomes indicated that the various light sources tested did not considerably impact the microhardness of human enamel following therapy with 35% hydrogen peroxide.

Additionally, de Arruda et al. researched the microhardness and histomorphology of bovine enamel after using 35% hydrogen peroxide. The specimens in this research were adapted to detachable devices that were used by individuals going through a dental caries challenge. It was ended that 35% hydrogen peroxide enhanced the decrease in hardness and histomorphologic modifications in the enamel surfaces revealed to cariogenic difficulty.

4. CONCLUSION

Tooth bleaching is among the most conservative and cost-effective dental therapies to improve or enhance a person's smile. Nonetheless, tooth whitening is not safe and just limited long-term clinical information are offered on the side effects of tooth whitening. Accordingly, tooth whitening is best performed under specialist guidance and following a pre-treatment dental examination and diagnosis. In consultation with the patient, the most appropriate whitening therapy choice(s) might be selected and recommended based on the patient's lifestyle, financial considerations, and oral health. Finally, Clinicians should inform their patients regarding the feasible changes that might occur on their dental restorations during whitening procedure in addition to the possibility of replacement of the bleached restorations at the end of bleaching treatment.

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