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Side Effects of Using Teeth Whitening Products: Literature Review

Aryo Sutowijoyo[1], Rangga Surya Fathrianto[1], Bingah Fitri Melati[1]
[1]*Faculty of Dentistry, Universitas Muhammadiyah Surabaya, Indonesia*

Abstract : The beauty of a smile is influenced by many factors, one of which is the bright color of the teeth. To achieve better aesthetics or appearance, the demand for teeth whitening is increasing. Effective teeth whitening treatments can help reduce and improve the appearance of full or partial denture restorations. Apart from their effectiveness in whitening teeth, teeth whitening products have side effects. This type of research is a literature review with thematic analysis method to analyze data from various literature sources, including books/e-books, regulations, policies, modules, journal articles and other publications. The focus of this research analysis is on the side effects of using teeth whitening products. There are several side effects from using teeth whitening agents, including increasing tooth sensitivity, acute cytotoxicity or poisoning of teeth whitening agents, tooth resorption, changes in the surface of tooth enamel, and changes in the formation of existing tooth fillings. Teeth whitening treatment must be carried out carefully with good planning before treatment, to minimize risks that may arise during treatment.

Keywords – *Side Effects, Teeth Whitening, Products*

I. INTRODUCTION

Teeth are one of the smallest organs in the body which, if not cared for properly, can cause various diseases, including genetic diseases[1]. Several genetic diseases such as dentinogenesis imperfecta, dentin dysplasia and several types of amelogenesis imperfecta can cause pathological conditions in postnatal teeth, especially during tooth formation[2]. The condition can be triggered by several diseases such as jaundice, congenital erythropoietic porphyria, cholestasis and kidney disease as well as by the use of tetracycline or ingestion of fluoride in childhood which can result in undesirable tooth staining. This is caused by one of the intrinsic factors, namely fluorosis where dentin has formed[3].

Dental fluorosis is a discoloration that occurs in the teeth due to excessive fluoride consumption. Teeth color is an important factor that influences the beauty of a smile. In cases like this, there is a need for society to improve the quality of life and aesthetics/appearance by whitening teeth. Effective teeth whitening treatments can help reduce and improve the appearance of full or partial denture restorations. On the other hand, teeth whitening treatment is the easiest and least damaging method for brightening the color of teeth[4].

Research by Abdul, et al (2018) revealed that of 294 respondents, 46.3% of respondents felt dissatisfied due to poor tooth color. As many as 86% of respondents have tried to improve the appearance of their teeth by using teeth whitening products at home, while only 9% have done so at the dentist's office. Toothpaste is the most widely used product (90.1%), followed by dental gel (7.9%), and 2% use white strips[5].

Correct teeth whitening treatment can minimize the impact on clinical tolerability. This can be done in a dentist's practice, by supervisory staff at teeth whitening place, or at home under the supervision of a dentist[6].

Teeth whitening devices that are widely sold freely can be used by the public without professional supervision, but must still be adapted to specific needs to achieve the desired results. However, if this is violated and approaches the risk limit, it can cause unwanted side effects. The ingredients most widely used as the basis for teeth whitening treatments are Hydrogen Peroxide (H2O2) and Carbamide Peroxide (CP). CP is a stable compound that decomposes when in contact with water and is capable of releasing HP. Most teeth whitening agents contain HP because CP releases H2O2. The way these 2 materials work depends on the oxidation ability of the pigment molecules which causes colour changes[7].

Excessive and unsupervised use of these two ingredients can cause several effects that may occur after teeth whitening treatment. As the previous research found that teeth bleaching techniques generally use high concentrations of bleaching agents such as H2O2, which can harm dental health[8]. Information regarding the side effects of using teeth whitening products other than on hard tooth tissue is still limited[9]. So, the aim of this research is to find out what side effects can occur from using teeth whitening products.

II. METHODS

This type of research was a literature review with thematic analysis method to analyzed data from various literature sources, including books/e-books, regulations, policies, modules, journal articles and other publications. The focus of this research analysis is on the side effects of using teeth whitening products. Data collection began with a comprehensive literature search through several websites such as Google Scholar, Springer-link, ScienceDirect and several written in Indonesian and English related to the topic that was the focus of the research.

The next step is to carry out an in-depth analysis of all the literature that has been collected to fully understand its content. The collected literature is then reviewed, modified and developed according to the research topic to produce relevant and refined data to identify the core of each literature found.

III. RESULT AND DISCUSSION

Using teeth whitening products can cause various side effects that need to be taken into account. Excessive use of the product or not following the prescribed dosage can cause uneven tooth discoloration, as well as damage to the enamel which can accelerate the formation of caries. Some side effects of using teeth whitening products include:

a. Local and general toxicity effects of hydrogen peroxide (H2O2)

Hydrogen peroxide (H2O2) is teeth whitening agent that functions as a chemical oxidizer. The use of hydrogen peroxide is adjusted to the treatment location, whether at home or at the dentist's clinic. Each treatment location has a safe concentration for use according to the European Scientific Committee on Consumer Products (SCCP), which is around 6% if done at home without doctor supervision and 40% if done in a dental clinic. High or low concentrations that have been determined will still have a negative impact on teeth, such as sensitivity, tooth erosion and gum irritation[10].

- **Sensitivity**

  High concentrations of hydrogen peroxide (H2O2) can cause sensitivity in the dental pulp, because the tooth whitening process can change the properties of enzymes in the pulp. This sensitivity arises due to the diffusion of by-products through the dentin tubules that are formed during the use of hydrogen peroxide and carbamide peroxide[11].

- **Acute cytotoxic effects**

  Hydrogen peroxide solutions with concentrations of 10% or more can cause more serious effects. A concentration (H2O2) of 35%, which is equivalent to 290 mg/kg body weight, can cause fatal poisoning if swallowed by someone with symptoms such as vomiting, cyanosis, convulsions and respiratory failure. The acute cytotoxic effect depends on the amount ingested and the concentration of the solution[12].

  Apart from (H2O2), another teeth whitening ingredient is Carbamide peroxide which chemically consists of around 3.5 parts hydrogen peroxide and 6.5 parts urea. The concentration of use

(H2O2) in professional practice ranges from 25%-40%, while for home it ranges from 3-9%. However, recently there has been a trend to increase the concentration of hydrogen peroxide in over-the-counter products. This increase carries the risk of acute cytotoxicity and even death if swallowed and without professional supervision[13].

b. Local effects of bleaching agents on dental tissue and oral mucosa

Carbamide Peroxide as one of the bleaching ingredients with the lowest concentration, namely 2%, can cause irritation and inflammation of the tooth tissue, gingiva and oral mucosa. This is because Carbamide Peroxide is an unstable compound and when it breaks down this compound produces free radicals which are very dangerous. These oxygen free radicals are antigens that can induce a person's immune system(13; 14).

- **Effects on non-vital teeth (internal or external treatment): internal and external resorption**

  Non-vital teeth often require special treatment both internally and externally to overcome various problems. The two main problems that can affect non-vital teeth are internal resorption and external resorption. Side effects of non-vital teeth whitening treatment with internal treatment are external root resorption and ankylosis. Meanwhile, external treatment generally causes restoration edge leakage[16]. One of the treatments for cases of internal resorption is root canal treatment. After undergoing root canal treatment, the color of the treated tooth often changes and becomes less aesthetic over time. This usually occurs in incisors that have experienced local trauma. If the tooth color has become darker or grayish brown, whitening treatment may be an option, as this method requires less tooth tissue to be removed compared to preparation for the installation of crowns or veneers. Based on this, several effects can occur after root canal treatment is carried out[17].

- **Hypersensitivity and post-treatment pulp reactions**

  Hypersensitivity and post-treatment pulp reactions are two problems that can arise after various types of dental treatment, such as teeth whitening. Hypersensitivity can occur due to cold stimulation which can trigger pain in cases of hypersensitive dentin. Gargling with mouthwash causes a cold feeling in the teeth and mouth. The active ingredient in mouthwash is Carbamide peroxide. Carbamide peroxide at a concentration of 10% can also trigger tumor development due to the presence of cells that have mutations[18].

c. Enamel surface changes: consequences on bacterial plaque adhesion and cariogenicity

Changes in tooth color caused by external factors occur on the outside of the teeth, namely on the enamel surface. These changes are caused by long-term and routine food consumption or daily habits. Cariogenicity of a food or drink is defined as the ability of a food to foster caries in humans under conditions conducive to caries formation[19]. Several types of foods/drinks that are cariogenic, such as chocolate, biscuits, coffee and tea, contain ingredients that increase the risk of tooth staining. Extrinsic staining can occur due to poor oral hygiene and consumption of foods and drinks that contain dyes. The extrinsic coloring in question is teeth whitening treatment that involves 2 active ingredients/compounds such as H2O2 and Carbamide Peroxide. When teeth change color, their surface will become rougher. A rough surface makes it easier for plaque to adhere, which over time will harden into calculus and cause further discoloration[18][19]. Acid production on dental plaque is an important caries risk factor because dental caries is initiated by demineralization on teeth surfaces by organic acids that were produced by bacteria in dental plaque[22].

d. Teeth whitening effect of peroxide on the oral and gastric mucosa

External treatment of vital teeth refers to interventions carried out on the outside of the tooth which are generally carried out to repair damage, improve aesthetics, or strengthen tooth structure. One of them is bleaching. Repeatedly swallowing bleaching gel containing peroxide can cause stomach pain. Apart from that, repeated use of whitening products at inappropriate doses also causes inflammation/burns on the oral mucosa[23].

e. Effects on restorative materials: release of mercury and silver from amalgam and detrimental effects on adhesive properties and on the margins of composite fillings

Dental restorative materials are used to repair damaged or cavities in teeth. Also included in teeth whitening treatments, the release of mercury and silver from amalgam can affect the aesthetics of fillings and also result in discoloration of tooth fillings. There is a change in color that is the basis for someone to

bleach. Teeth whitening agents containing H2O2 have been widely used, and in this case, cell lysis has been reported to occur even at concentrations as low as 1%. Both types of restorative materials have their own benefits and challenges. Selection of appropriate materials and treatment techniques by dental professionals can minimize risks and ensure optimal restoration results[24].

IV. CONCLUSION

Overall, all side effects of using teeth whitening products must be taken into account before deciding whether teeth whitening (bleaching) treatment is necessary and safe to undertake. Various teeth whitening methods need to be carefully controlled before planning, because all treatments have risks, both high and low.

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