

# Mouthwashes with hydrogen peroxide are carcinogenic, but are freely indicated on the Internet: warn your patients!

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It all began in Ancient Egypt where people used to bleach their teeth with antiseptic mouthwashes made of urea from human urine. Teeth harmony is promoted by expression of feelings, communication, a real window of the brain and its content! Tooth bleaching products are medicines, not cosmetics! Mouth washing with hydrogen peroxide is an illogical and dangerous procedure! Hydrogen peroxide must be used in one's mouth only when employed by a dentist who has been properly instructed to protect the mucosa, preventing it from receiving these products. How and for how long these products are going to be used require caution in order to avoid or decrease any adverse effects on the tissues. Many websites instruct people on how to purchase and prepare hydrogen peroxide so that it is used as an antiseptic mouthwash and tooth bleaching agent. Some websites even refer to dentists as "exploiters", accusing them of not instructing patients properly. In this article, we aim at providing evidence and information upon which dentists and assistants may base their thinking as well as their opinion and procedures regarding "the indiscriminate and free use of hydrogen peroxide in the mouth, on teeth and oral mucosa". Those websites, blogs and social network profiles trespass the limits of public trust and should be immediately sued by the government for committing a crime against public health.

**Keywords:** Hydrogen peroxide. Mouth washing. Rinsing. Teeth bleaching. Teeth whitening.

It all began in ancient Egypt where people used to bleach their teeth with antiseptic mouthwashes made of urea from human urine, although no object related to teeth cleaning has yet been found in Egyptian tombs.<sup>4,18</sup>

One of Aristotle's disciples reported that: shaving and having white teeth are a virtue that shall be cultivated. The Romans taught the Greek to clean their mouth and teeth with pumice, talcum and coral powder. The Athenian Diocles of Carystus wrote: Every morning, brush your gingiva and your teeth using your fingers with mint powder in order to remove any food debris.<sup>18</sup>

In the Roman Empire, bone ash, ground eggshell and ground coral mixed with honey formed a potassium carbonate and sodium-based product used for teeth cleaning and whitening.

Appearance is highly valued in nearly all human activities. The mouth and the smile are determining factors of beauty, including inner beauty. Teeth are in harmony with the expression of feelings and human communication. My assertion that "Being smart is being happy!" implies joy, showing mouth and teeth, the real outer expression of our inner self or of our "heart", a window to our

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brain and its most valuable content! In the most developed and socially assisted societies, the integrity of teeth has been increasingly preserved as a result of prevention against caries and periodontal disease. Periodontal disease is related to dental plaque which is a result of lack of education and poor oral hygiene. The more educated and assisted the people are, the more they value subtleness and details, inducing patients to worry about the appearance of their teeth, gingiva and lips. The following are among some of the concerns raised:

- » Tooth color, shape and size.
- » Tooth positioning and arch symmetry and its harmony with lips and smile.
- » Lamellas, small fractures and loss of structure due to friction, abrasion, abfraction and erosion.

Esthetics has been increasingly valued, and each detail represents a differential within this competitive world. Esthetic procedures and products are widely known, applied and negotiated. In human resources, selecting candidates to play specific roles in the market depends on the candidate's appearance, beauty and visual seduction power.

To be classified as cosmetic, the products cannot be used for any treatment and must not change body physiology. Teeth bleaching products should not be classified as cosmetic products because they change the physiology of where they act — for instance, the enamel, dentin, pulp, gingiva and oral mucosa. Using bleaching gel without supervision may not only cause hypersensitivity, but also stain the teeth.

During a meeting held with the Brazilian Health Surveillance Agency (ANVISA), some Brazilian dental organizations requested a public consultation on which it was proposed that a new regulation on the commercialization of tooth bleaching agents should be introduced. Such regulation would require that tooth bleaching agents were only sold under prescription, given that these agents are not classified as cosmetics, but as medicines. These organizations are: Regional Council of Dentistry/São Paulo, Association of Dental Surgeons/São Paulo (APCD Central), representatives of the Brazilian Association of Medical, Dental, Hospital and Laboratory Supplies and Equipment Industry, and the dental industry which produces tooth bleaching products. The changes proposed involve regulating and establishing criteria for packaging, labeling, distributing and controlling tooth bleaching agents and classify them as medicines.

They will be sold on prescription written by a dental surgeon and under supervision. Additionally, prescription will have to be retained, as it happens with antibiotics, in Brazil. Classifying tooth bleaching agents as medicines require that they have a red label on their package. The regulation stipulates that whitestrips and tooth bleaching products or agents be sold at drugstores and on the internet only on prescription.

## WHAT IS THE PURPOSE OF THIS ARTICLE?

Any professional who is committed to Dentistry and public health issues must induce patients to ponder on the responsibilities related to themes that are important to enlighten professionals, technicians, manufacturers and end-user patients.

Ignorance, or lack of knowledge, opens the door to opportunists who aim at achieving success and wealth at any cost, at the expense of anyone and not complying with human and social values previously established.

On the internet, there is a wide range of websites that recommend and teach step by step, with videos and other resources, how to purchase and prepare hydrogen peroxide to be used as mouthwash and as an antiseptic solution that cleans and bleaches the teeth. These websites even refer to dentists as “exploiters”, accusing them of not instructing patients properly because they wish to earn profits, only.

Even though this article seems to be redundant, it aims at informing, as we have already done in previously published periodicals that deal with the same theme, and laying the basis upon which dentists and assistants of all specialties may base their thinking as well as their opinion and procedures regarding “the indiscriminate and free use of hydrogen peroxide in the mouth, on teeth and oral mucosa”.

It is of paramount importance that we highlight the fact that hydrogen peroxide is harmful and plays a major role in chemical carcinogenesis that occurs not only in the mouth, but also elsewhere. Researches reveal the induction of carcinomas and adenocarcinomas in the duodenum as well as all over the gastrointestinal tract.<sup>10-13</sup>

## UNDERSTANDING ORAL CHEMICAL CARCINOGENESIS

When chemical substances act in the oral mucosa, they cross its most superficial and thin layer and penetrate the epithelial cells. These substances may reach the

nucleus of the cell where the 46 chromosomes that contain the DNA are and in which the 25 thousand pieces of information that guide body functioning, known as genes, are found.

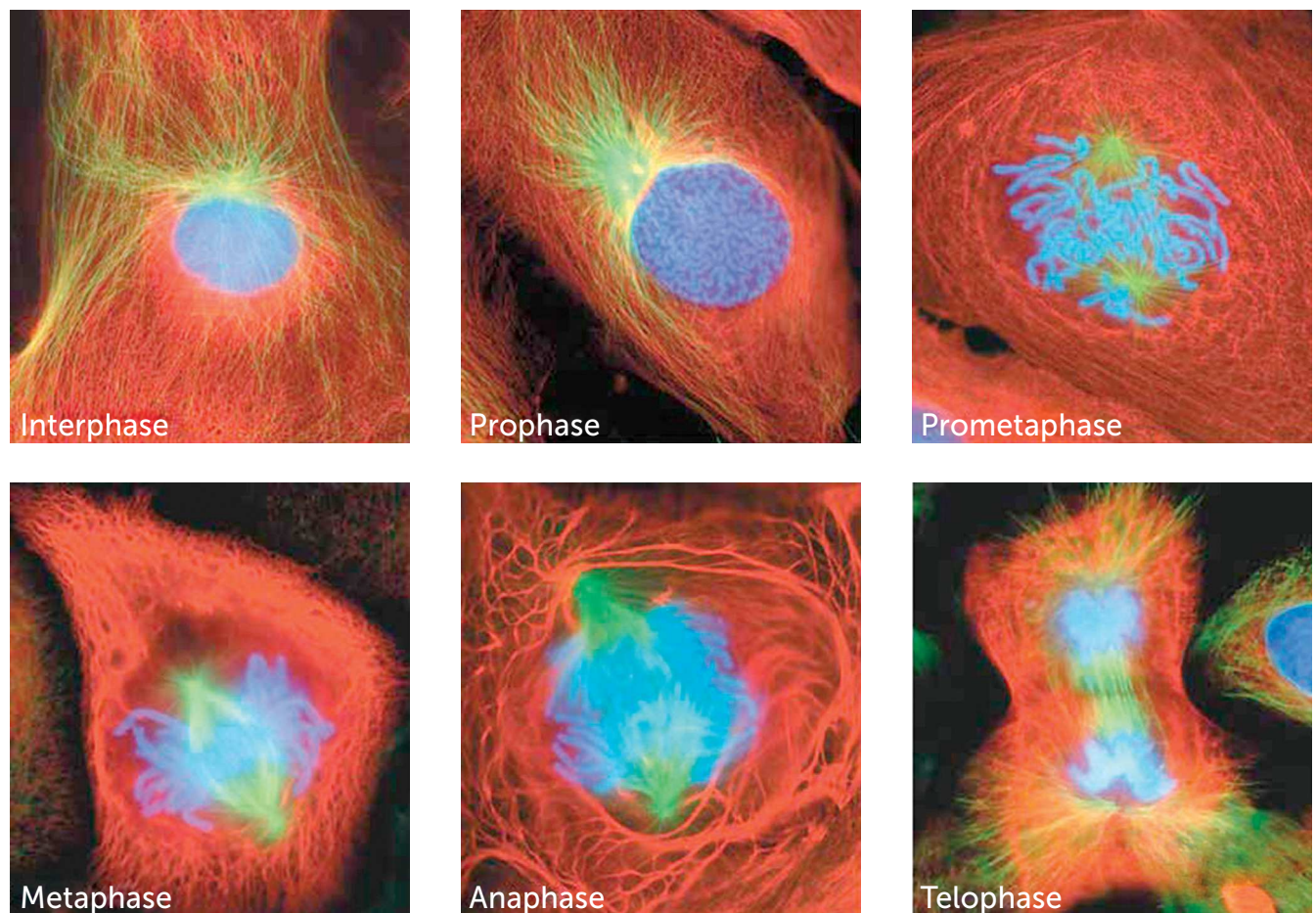
» **The initiation stage: the beginning of chemical carcinogenesis.** A chemical substance may irreparably harm the DNA structure and, as a consequence, the genes that control, directly or indirectly, cell proliferation. This stage, known as initiation, remains latent and does not act in the cell and/or the tissue. It begins with the action of the chemical agent and ends when changes are detected in cell structure.

» **The promotion stage: stimulation of chemical carcinogenesis.** Some substances cannot initiate any changes in DNA, but if they act upon it, they can promote phenotypic expression of changes initiated by other chemicals. From that point onwards, those that have been initiated begin to proliferate, and a

new cell population is formed. This stage is known as promotion: the promoting agents are also known as carcinogens, since they increase the activity of the carcinogenic initiating agents and speed up neoplastic cell transformation.

Due to being abundant in the environment, the promoting agents play an important role in the prevalence of malignant neoplasm. It may be of chemical nature, but promoting agents may also be of biological and physical nature. Promoting agents do not cause neoplasms alone, they act over initiated cells.

We often devalue environmental factors as carcinogenic agents. Such factors include, but are not limited to: sodium nitrate present in smoked meat, cyclamate in artificial sweeteners, glutamate in food thickener, benzopyrene and hydrocarbons present in tobacco, and aflatoxin produced by a fungus present in badly conserved grains (peanut, for example).



**Figure 1** - Mitosis phases for copy/duplication of genes. The mitosis process of each one of the 10 trillion cells of the human body continuously occurs and duplication of the 25 thousand genes represents an opportunity for initiating and promoting agents to act. Each chromosome (in blue) has an average of 1,000 genes that will be duplicated in each mitosis process. All changes are summed up over time.



Tooth bleaching agents, all hydrogen peroxide-based, are carcinogenic agents. In other words, they potentiate the action of other chemicals (which are widely present in our daily routine) over the DNA of cells present in the oral mucosa, just like alcohol does. This effect on the DNA, which is produced by hydrogen peroxide, has been proved by many researches.<sup>1,10,11,12,13,17,19,20</sup>

» **The progression and clinical expression stages.** In the progression stage, the initiated and promoted cells proliferate. The period is extended until clinical or imagi-nologic onset of neoplasm occurs, and that is when the period of clinical expression begins and the lesion can be clinically diagnosed as cancer. Some chemical agents may contribute to slow down or speed up both stages (pro-gression and clinical expression).

» **Influence of age, frequency of use and chemical concentration.** Out of the three characteristics mentioned, when carefully assessed by experimental studies, the most important one is the frequency of application and use of a chemical substance. Age and sex did not prove to be decisive factors in chemical carcinogenesis, whereas concentration presented little influence, since low concentrations did not result in substantial effects.

Using hydrogen peroxide and alcohol on a daily/week-ly basis encourages the promotion of malignant neoplasm in the oral mucosa. Alcohol, for instance, potentiates in 50 times the harm caused by tobacco. Mouth washing with hydrogen peroxide, using products made with alcohol or drinking alcohol everyday may lead to the risk of oral chemical carcinogenesis.<sup>5,14</sup>

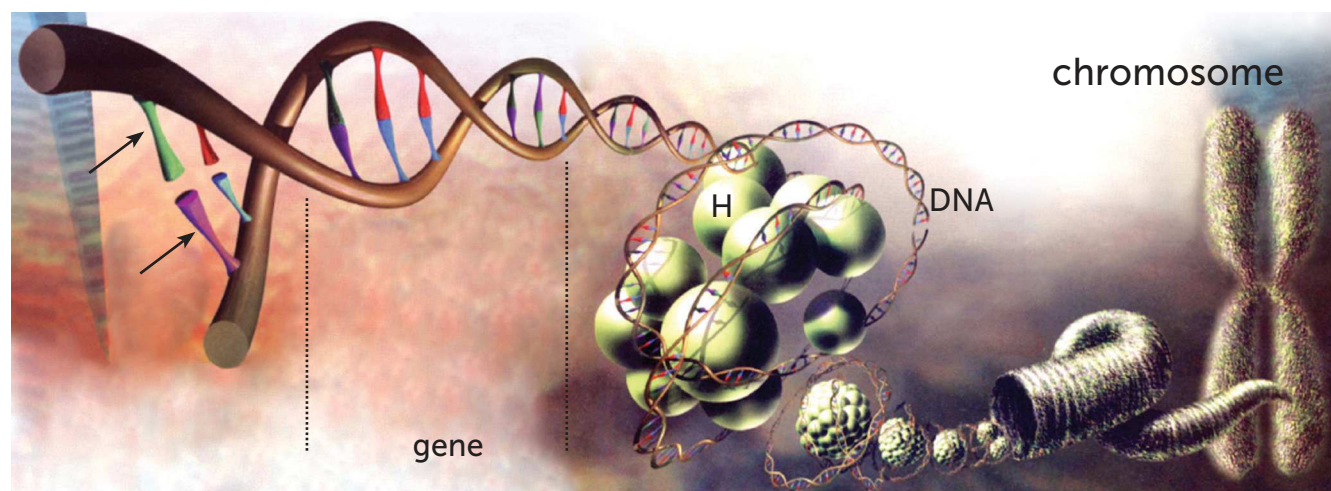
## IF WE SHOULD BE CAREFUL WITH TEETH WHITENING, WE SHOULD BE EVEN MORE CAREFUL WITH HYDROGEN PEROXIDE USED AS MOUTH-WASH ON A DAILY BASIS!

It is worth noting that tooth bleaching agents are based on the effects of hydrogen peroxide acting on dental tissues. Their concentration, presentation, pack-age, chemical formula and other variables result in generating hydrogen peroxide.

Also known as urea peroxide, sodium perborate, carbamide peroxide or other less common names, the hydrogen peroxide may have deleterious effects on the enamel, dentin, cementum, pulp and gingiva.<sup>6</sup> These names vary according to the presentation and formula-tion of the product. However, if both formulation and presentation of the product are controlled, and if the product is properly applied by a professional who takes the appropriate compensatory measures, its use is safe.<sup>8</sup>

In the oral mucosa, hydrogen peroxide potentiates the effect of many other carcinogenic agents found in patient's mouth. These carcinogenic agents may origi-nate from food, cosmetics, hygiene products, pesticides, herbicides, tobacco, alcohol, virus, among others.<sup>1,17</sup> Such potentiation happens due to the fact that these products are promoting agents of oral chemical carcinogenesis.

There are many carcinogenic products available for sale, for instance: alcoholic beverages, cigarettes, ground tobacco, medicines, insecticides and others. These prod-ucts are sold directly to the consumer after warnings and awareness campaigns had been carried out. That is



**Figure 2** - The 46 chromosomes of each human cell contain 25 thousand genes. Each segment of DNA that represents a piece of information is named gene, with its nitrogenous base (arrows). The initiating agents can change this sequence of bases and promote permanent mutations. The promoting agents potentiate these mutations and break out cell proliferation of these mutated cells, thus, originating a neoplastic cell clone (histone = proteins that sustain the winding of DNA in chromosomes as bobbins).

how democracy works; products are sold directly to the consumers, but with a wide range of awareness, classification and explanatory campaigns stating that these products are carcinogenic.

As for health professionals, they must neither apply nor recommend carcinogenic products to their patients, unless they have no other therapeutic option and the cost/benefit of using these products has been carefully assessed and discussed with the patient. That is similar to what happens when oncology-chemotherapy, radiotherapy and medical treatments, in addition to other options used for autoimmune diseases, are prescribed.

The choice between the risk of carcinogenic action in the oral mucosa and the benefit of tooth bleaching must be carefully analyzed prior to the use of hydrogen peroxide. Thus, those patients who wish and/or professionals who recommend tooth bleaching procedures must be aware that tooth bleaching products present carcinogenic characteristics that act in the oral mucosa. Only after that professionals should take the preventive measures that are necessary to prevent these products from touching the soft tissues. Resin protective barriers and/or other isolation devices may be used to protect the oral mucosa and prevent the patient from swallowing the tooth bleaching product. Additionally, these barriers/isolation devices are able to protect the tooth cervical region which is so fragile and in which dentin gaps may be present.<sup>2,6,7,8,16</sup>

If patients use tooth bleaching products at home, they are not adequately protected and the contact between hydrogen peroxide and oral, pharyngeal and other gastrointestinal mucosas is inevitable.<sup>2</sup>

When patients use tooth bleaching products at home, they tend to use them for a longer period of time and more often than what has been recommended to them. Using tooth bleaching products at home may “bleach patient’s teeth quicker and more intensively”, since the procedure is carried out without control and/or any restriction.

However, the ideal teeth whitening procedure must be carried out directly by the professional, and not under his supervision, only. Lay people, such as assistants and patients, are not trained and do not have knowledge or awareness to:

1) Totally remove any product residue with a suction device before the isolation device is removed and afterwards, only afterwards, water patient’s mouth.

2) Remove hydrogen peroxide with one tip of the saliva ejector, and eject saliva or water that has been blasted into patient’s mouth with another tip or with other ejector. Using the same tip of the ejector makes the tooth bleaching product touch the oral mucosa.

Mouth washing with hydrogen peroxide performed on a daily basis many times a day may seriously harm gastrointestinal mucosas. The potential of tooth bleaching agents to promote carcinogenesis occurs in the entire gastrointestinal tract.<sup>1,17</sup>

### **MORE INFORMATION ABOUT MOUTH WASHING WITH HYDROGEN PEROXIDE AND TEETH WHITENING**

In order to kill bacteria, our cells phagocytize and conglobate them into intracytoplasmic vacuoles (real “balloons” or bags that can be compared to a gas chamber) where powerful substances such as enzymes, chlorine solutions and hydrogen peroxide are thrown. Cells throw these substances only after it is certified that their vacuole walls are preserved — should there be any lesion, the cell dies: hydrogen peroxide and chlorine are lethal. When hydrogen peroxide acts directly on tissues, it is transformed into hydroxyl radicals and superoxides that are extremely toxic and reactive. They produce devastating effects by oxidizing vital components, such as cell membrane and DNA, and may cause mutations.

A long time ago, men discovered that hydrogen peroxide dissolves the remnants of necrotic cells and tissues, which decreases the amount of microorganisms and facilitates antibiotic action. However, hydrogen peroxide must be used in very specific cases, at appropriate concentrations and by properly qualified professionals, as recommended by the Food and Drug Administration (FDA), which classified it as a debriding agent to be temporarily used in the oral cavity.<sup>3,9</sup> A multinational company has recently removed a hydrogen peroxide-based antiseptic from the market, probably because people were inappropriately using it, with regard to location, time and frequency of application.

Chlorine and hydrogen peroxide-based solutions can be found inside cupboards at our homes, but must remain far away from children and animals. Indications for use and cautions must be followed, and the manufacturers must provide a contact number in case of intoxication. They are toxic caustic products that may even lead to one’s death if we do not properly follow the instructions for use.

People using cleaning and hygiene products with hydrogen peroxide and chlorine solutions must wear safety gloves, but many people prefer handling them with unprotected hands and, in general, nothing happens. Our skin has a thick and resistant protection layer: the keratin. This layer cannot be easily penetrated given that it is thicker in hands and teeth than in other parts. The following is among the recommendations of caution and limitation of use for these products: protect oral, genital, nasal, ocular and other mucosas. Mucosas do not have the keratin layer, and when they do, it is very thin.

On the internet, probably due to ignorance about the principles of Chemistry, Cosmetology, Medicine and Dentistry, some people have irresponsibly recommended hydrogen peroxide as a mouthwash capable of decreasing the amount of germs in the mouth and reducing gingival inflammation while cleaning and bleaching the teeth. Those people should be notified and sued by the government for committing a crime against public health and for trespassing the limits of public trust.

Hydrogen peroxide reddens the mucosa and gingiva by wounding them with tissue dissolution and inflammation. Hydrogen peroxide burns and may lead to necrosis of gingival papillae. It completely cleans the teeth because it demineralizes the enamel and also removes dirt or pigments. The enamel becomes porous<sup>2,6</sup> and food stains it even more, increasing the need for mouth washing. Enamel becomes thicker everyday. Should there be any restoration, it will induce microleakage through its interface with the tooth, causing the enamel to come out easily while eating.

If burning the mucosa and demineralizing the enamel were the biggest problems, we could think about using hydrogen peroxide with moderation. However, the biggest problem is that hydrogen peroxide is a promoting agent. In other words: it potentiates the effect of inducers of oral, throat, esophagus, stomach and intestine cancer. Pesticides, tobacco products, alcohol, HPV and other oncogenic viruses, sunray and chemicals found in industrialized food are potentiated by hydrogen peroxide.

Many doctoral dissertations, master's thesis, researches and books confirm what the literature has already proved by means of different methodologies.<sup>1,17</sup> *In vivo* chemical carcinogenesis experiments prove the

carcinogenic effect of hydrogen peroxide on the mucosa that receives tooth bleaching products, antiseptics and tooth paste.

In the thesis written by Pieroli,<sup>17</sup> in 1997, at the University of São Paulo (USP), the carcinogenic effect of tooth bleaching products on hamsters was compared to DMBA, a drug that has been especially developed for experiments involving induction of oral and skin cancer. During 22 weeks, it was observed that tooth bleaching products alone were not capable of inducing oral cancer. However, when they were alternately applied with DMBA, the number of animals with cancer and the size of the lesions increased, which suggests that hydrogen peroxide does not initiate, but stimulates the proliferation of cells modified by another carcinogenic agent. When a chemical substance has this property, it is named as "promoter", and it can strongly act in the mouth, since that is where many initiators are.

In his doctoral dissertation written in 1999 at USP, Camargo<sup>1</sup> assessed the carcinogenic effect of hydrogen peroxide-based tooth pastes. Out of 30 brands, 29 had hydrogen peroxide in their formula, including tooth paste for children. However, most of these products did not state on their package the presence of hydrogen peroxide. In the hamsters used for that research, the effect of hydrogen peroxide present in tooth pastes was similar to tooth bleaching products applied alone: it was a carcinogenesis promoter.

Tooth bleaching products are part of the modern culture and we must progress technologically to reduce their undesirable effects. Teeth whitening must be safe and the conscious option of not carrying it out must be respected. Thus, the packages should provide this information, so the consumer has the option of choosing between tooth pastes with or without hydrogen peroxide.

### **"HOMEMADE" TEETH WHITENING. WHY NOT?!**

Does teeth whitening has the same carcinogenic effect at the clinic and at home? No. A qualified professional uses isolation devices, such as a resin cervical barrier or other mechanical/physical devices, to prevent tooth bleaching products from touching the mucosa. Before removing both the tooth bleaching product with water and the resin cervical barrier, the bleaching product must be totally ejected. Only after it has

been completely removed, the resin cervical barrier or other isolation devices are taken off. At the clinic, the amount of tooth bleaching product that touches the mucosa is very low and occasional. Conversely, during brushing, the product touches the mucosa on a daily basis, similar to what occurs when hydrogen peroxide is used as a mouthwash or when whitening strips are continually used.

Does at-home dental bleaching present higher risks? Yes, because even if patients have been instructed by the professional and the application tray has been properly adapted, patients tend to let dental bleaching product spread in the mouth with their saliva. It will inevitably touch the oral mucosa for a long period of time and its partial ingestion will cause it to reach the gastrointestinal mucosae.

Self-medication is quite frequent and the product may be purchased without the prescription of a professional. For this reason, it is wrongly and carelessly used at home. Lack of control over time and frequency of use may enhance teeth bleaching, but at the expense of biological effects on the mucosa and teeth, which is not worth the risk (unmeasurable in the future). Tooth bleaching products must be considered as medicines, and their use must be restricted to dentists duly trained to carry out the procedure. Unfortunately, they are freely sold and not everyone is aware of their risks.

## **FINAL CONSIDERATIONS ABOUT MOUTH WASHING WITH HYDROGEN PEROXIDE**

All procedures carried out with hydrogen peroxide in the mouth with the purpose of whitening the teeth should be performed directly by a dentist who has been properly trained to prevent the oral mucosa from receiving this product during the procedure. The time and method of use require caution in order to decrease, to the minimum, the undesirable effects of hydrogen peroxide on tooth tissues and restorations. Whitening strips and other tooth bleaching products are all hydrogen peroxide-based.

Should mouth washing with hydrogen peroxide be occasionally done, touching the oral mucosa once a year or every six months, it would cause minor cocarcinogenic effects. However, should it be done everyday or every week, as an antiseptic used to help with oral hygiene, it would become a protocol that is highly reckless to health! Websites, blogs and social network profiles that recommend the procedure should be immediately sued by the government!

Esthetics comprises harmony between shape, size, position and color. If we take a closer look at some people's smile and notice red gingiva and lips with extremely white teeth, the diagnosis of excessive use of hydrogen peroxide is inevitable: artificiality is evident. Extremely white teeth and red gingiva and lips create a quite artificial picture from an esthetic standpoint!

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