



RESEARCH ARTICLE

ANTIOXIDANTS IN PREVENTION OF ORAL CANCER

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Abstract

Antioxidants in prevention of oral cancer provides a comprehensive introduction to the application and potential benefits of antioxidants in dental care. The article reviews the current literature on oxidative stress and its implications in oral diseases, highlighting how antioxidants combat these effects. It discusses various antioxidants, including natural and synthetic types, and their specific roles in preventing and treating periodontal disease, caries, and post-surgical complications. The summary underscores the importance of antioxidants in enhancing standard dental therapies and promoting oral health. While advocating for their inclusion in dental practices, the article also calls for more research to establish standardized protocols and dosages.

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Introduction:-

An antioxidant is a molecule capable of slowing or preventing the oxidation of other molecules. Although oxidation reactions are critical for life, they can also be damaging. Oxidation reactions can produce free radicals, which damage cells. Antioxidants terminate these reactions by removing free radical intermediates, and inhibit other oxidation reactions by being oxidized themselves. Low levels of antioxidant molecules or inhibition of these antioxidant enzymes causes oxidative stress and may damage or kill cells. Hence, plants and animals maintain complex systems of multiple types of antioxidants, such as glutathione, vitamin C, vitamin E as well as enzymes such as catalase, superoxide dismutase and various peroxidases.¹

Antioxidants

“Antioxidants are substances or agents that scavenge reactive oxygen metabolites, block their generation or enhance endogenous antioxidant capabilities.”¹⁵

The definition proposed by the Panel on Dietary Antioxidants and Related Compounds of the Food and Nutrition Board is that:

“A dietary antioxidant is a substance in foods that significantly decreases the adverse effects of reactive oxygen species, reactive nitrogen species, or both on normal physiological function in humans.”

1. Enhancing the endogenous antioxidant capability of the target.
2. Blocking the chain propagation of secondary oxidants.

Blocking the secondary generation of toxic metabolites and/or inflammatory mediators.

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Classification**A) Antioxidants in relation to lipid peroxidation:**

- 1) **Preventive antioxidants** that will block the initial production of free radicals. eg. catalase, glutathione peroxidase.
- 2) **Chain breaking antioxidants** that inhibit the propagative phase of lipid peroxidation. eg. superoxide dismutase, vitamin E, uric acid.

B) Antioxidants according to their location:

- 1) **Plasma antioxidants** - β -carotene, ascorbic acid, bilirubin, uric acid, ceruloplasmin, transferrin.
- 2) **Cell membrane antioxidants** - α -tocopherol.
- 3) **Intracellular antioxidants** - superoxide dismutase, catalase, glutathione peroxidase.

C) Antioxidants according their nature and action:

- 1) **Endogenous Antioxidants** -
 - **Enzymatic antioxidants** - superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase.
 - **Non-enzymatic antioxidants**
- i. **Nutrient antioxidant** - carotenoids (β -carotene), α -tocopherol, ascorbic acid, selenium.
- ii. **Metabolic antioxidant** – glutathione, ceruloplasmin, albumin, bilirubin, transferrin, ferritin, uric acid.
- 2) **Pharmacological Antioxidants** – Xanthine oxidase inhibitor, protease inhibitors etc.

Role Of Antioxidants In Orofacial Disorders**Leukoplakia**

Benner SE et al (1993) conducted a study to evaluate the toxicity and efficacy of **α -tocopherol** in patients with oral leukoplakia and to assess the feasibility of performing chemoprevention trials through the network of the Community Clinical Oncology Program (CCOP). α -tocopherol was used to treat oral premalignant leukoplakia. Administration of **α -tocopherol** resulted in both clinical and histologic responses in premalignant leukoplakia lesions.⁴⁴ **Zakrzewska JM et al. (2005)** conducted a randomized controlled trial which demonstrated clinical as well as improvement in the patients with oral leukoplakia by the treatment with lycopene per day over a period of 3 months. In patients treated with lycopene per day, positive histologic changes were also noted.⁶⁰

Lichen Planus

Sloberg K et al (1983) treated patients with chronic oral lichen planus, usually of the atrophic-erosive type for 2 months with **Etretinate**, followed for 4 months by **Etretinate**, **Tretinoin** in an adhesive base. Complete resolution or improvement was seen in 85% of the lesions after first treatment. They concluded that **Retinoids** offer an effective mode of therapy for severe oral lichen planus.⁶⁴ **Woo TY et al (1985)** suggested that in their study systemic **isotretinoin** may have a unique position in the treatment of mucous membrane lichen planus that is refractory to conventional therapies.⁶⁶ **Laurberg G et al (1991)** conducted a study on 65 patients with lichen planus in a multicenter trial of **acitretin**. This study shows that **acitretin** is an effective and acceptable therapy for severe cases of lichen planus.

Oral Submucous Fibrosis

Nayak A et al. (2015) conducted a study on 72 patients with OSMF. Out of 72, 24 patients were given lycopene, other 24 with lycopene + Vitamin E and remaining 24 were on placebo drug. The results obtained showed Lycopene in combination with vitamin E was found to be significantly efficacious in the improving signs and symptoms of OSMF. Hence it was concluded that Lycopene in combination with vitamin E is a highly efficacious drug in the management of oral submucous fibrosis which is proven to be as safe and reliable treatment method.⁹¹

Oral Cancer

It appears that **retinyl acetate**, administered systemically, can retard tumor development even after leukoplakia has been established and tumors have begun to develop.⁹² Daily treatment with high doses of **isotretinoin** is effective in preventing second primary tumors in patients who have been treated for squamous-cell carcinoma of the head and neck, although it does not prevent recurrences of the original tumor.⁹⁵ **vitamin E** singly or in combination with vitamin C plays a role in the inhibition of tumor cell growth.¹⁰² α -tocopherol is an effective antioxidant at high levels of oxygen, protecting cellular membranes from lipidic peroxidation. The main actions include free radical

scavenging, inhibition of cancer cell growth/differentiation, cytotoxicity, it inhibits mutagenicity and nitrosamine formation and prevents DNA, RNA, and protein synthesis in cancer cells.¹⁰⁷

Risks Of Antioxidant Supplements

Among a large group of pregnant women, it was discovered that 1.4% of them averaged more than 10,000 IU of vitamin A per day from supplements, and it was estimated that 1 of every 57 babies born to this group of women would have a birth defect attributable to their vitamin A intake. The possibility of developing squamous cell carcinoma is a concern when using antioxidants to treat patients with pre-malignant oral lesions and should be expected to occur in some patients. **Mitchell AA et al (1995)** conducted a study from M. D. Anderson Cancer Center reported that 17 out of 70 (24.3%) patients with premalignant oral mucosal lesions develop either in situ or invasive carcinoma within the median follow-up time of 66 months after supplementation began with 13-cis-retinoic acid and β -carotene or both. Of their patients, 86% were diagnosed histologically as either having hyperplasia or mild epithelial dysplasia at the beginning of the study. Therefore, a relatively high percentage of supplemented patients experienced a malignant transformation despite favourable baseline histologic diagnosis.

Is it possible that antioxidant supplements promote carcinogenesis instead of retarding it? There is in vitro evidence that ascorbic acid acts as pro-oxidant by increasing oxidative damage. This malignant transformation may have occurred without the use of antioxidants, but the possibility should be considered (**Schwartz J et al,1993**).⁹⁷

Conclusion:-

Antioxidants are being widely used in routine general clinical practice. They are also used in the prevention of cellular damage, the most common pathway for cancer, aging and a variety of disease. Dietary antioxidants like Vitamin C, Vitamin E, Carotenoids may also be of significance in the prevention of degenerative disease and maintenance of good health. There is now convincing evidence that foods containing antioxidants may be of major importance in disease prevention. The focus should not be on treating various diseases with antioxidants, but on the intake of a balanced diet with emphasis on antioxidant-rich fruits, vegetables, nuts, whole grains as has been recommended for the general population. Considerable evidence indicates that foods with high antioxidants nutrients play a major role in disease prevention. Efforts should be made to make these important molecules as our daily health regimen.

Unfortunately, antioxidants are not the “magic bullets” for the treatment of pre-malignant oral mucosal lesions or the prevention of second primary malignancies. However, there is a role if antioxidants are used judiciously in selected cases that can be monitored carefully. An important principle is that the treatment should not be more harmful than the damage that the lesion can cause.

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