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Review Article

Antioxidants: Their role in oral health- A short review

Arpan Manna[1]*, **Tanha Khan**[2]

[1]*Teerthanker Mahaveer Dental College & Research Centre, Bagadpur, Uttar Pradesh, India*
[2]*Daswani Dental College and Research Centre, Ranpur, Rajasthan, India*

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ABSTRACT

Antioxidants play a crucial role in maintaining good oral health by preventing and treating a variety of oral diseases. Periodontal disease, oral cancer, and tooth decay are all conditions that can be prevented or treated with the help of antioxidants. Antioxidants help neutralize the free radicals that cause cellular damage and inflammation, which can contribute to the development of these diseases. Antioxidants reduces inflammation in the gums and improve overall gum health, protect against the harmful effects of carcinogens that can cause oral cancer, and prevent tooth decay by neutralizing the acids produced by bacteria in the mouth. Some common sources of antioxidants include fruits, vegetables, nuts, and seeds, which are rich in vitamins C and E, as well as other beneficial compounds such as carotenoids and flavonoids. By including antioxidant-rich foods in our diets and practicing good oral hygiene, we can help protect our teeth and gums from damage and maintain a healthy and beautiful smile.

1. Introduction

Antioxidants are naturally occurring compounds that help protect our cells from the damaging effects of free radicals. Free radicals are highly reactive molecules that can cause cellular damage and inflammation, which can contribute to the development of various diseases, including cancer, heart disease, and diabetes.[1]

In the context of oral health, antioxidants have been found to play a crucial role in preventing and treating a variety of oral diseases, including periodontal disease, oral cancer, and tooth decay.

Periodontal disease, which is characterized by inflammation of the gums and the surrounding tissues, is a common oral disease that affects millions of people worldwide. Studies have shown that antioxidants can help reduce inflammation in the gums and improve overall gum health. This is because antioxidants help neutralize the free radicals that cause inflammation and damage to the gum tissues.[2]

Oral cancer is another serious oral disease that can be prevented and treated with the help of antioxidants. Research has shown that antioxidants can help protect the cells in the mouth from the harmful effects of carcinogens, which are substances that can cause cancer. This is because antioxidants help neutralize the free radicals that can damage DNA and other cellular components, which can lead to the development of cancer.

Antioxidants can also help prevent tooth decay by neutralizing the acids produced by bacteria in the mouth. These acids can erode the enamel of the teeth, leading to cavities and other dental problems. By neutralizing these acids, antioxidants can help protect the teeth from damage and decay.[2]

Some common sources of antioxidants include fruits, vegetables, nuts, and seeds. These foods are rich in vitamins C and E, as well as other beneficial compounds such as carotenoids and flavonoids. Some examples of antioxidant-

* *Corresponding author*.
E-mail address: arpanmanna97@gmail.com (A. Manna).

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rich foods include berries, citrus fruits, spinach, kale, almonds, and walnuts.

Antioxidants play a crucial role in maintaining good oral health by helping to prevent and treat a variety of oral diseases. By including antioxidant-rich foods in our diets and practicing good oral hygiene, we can help protect our teeth and gums from damage and maintain a healthy and beautiful smile.[3]

Antioxidants work by neutralizing free radicals, preventing them from causing further damage to cells and tissues.

2. Free Radicals

Free radicals are highly reactive molecules that can cause damage to cells and tissues in the body. They are produced as a natural byproduct of various metabolic processes in the body, as well as by external factors such as exposure to radiation and pollution.

Free radicals can cause damage to cells by stealing electrons from other molecules in the body, which can disrupt normal cellular processes and lead to oxidative stress. This can contribute to the development of various diseases, including cancer, heart disease, and Alzheimer's disease.[4]

Antioxidants are compounds that can help protect the body from the damaging effects of free radicals. They work by neutralizing free radicals and preventing them from causing damage to cells and tissues. Antioxidants can be found in a variety of foods, including fruits, vegetables, nuts, and seeds.

Some examples of antioxidants include vitamins C and E, beta-carotene, and selenium. These compounds work by donating electrons to free radicals, which neutralizes their harmful effects and helps protect the body from damage.[3]

In addition to their role in preventing disease, antioxidants have also been found to have anti-aging benefits. This is because oxidative stress and damage to cells can contribute to the aging process, and by neutralizing free radicals, antioxidants can help slow down this process.

Overall, free radicals and antioxidants play an important role in maintaining good health. By including antioxidant-rich foods in our diets and practicing healthy lifestyle habits, we can help protect our bodies from the harmful effects of free radicals and maintain optimal health and well-being.[5]

3. Oxidative Stress and Oral Diseases

Oxidative stress occurs when there is an imbalance between the production of free radicals and the body's ability to neutralize them with antioxidants. This can lead to cellular damage and inflammation, which can contribute to the development of various diseases, including oral diseases.[3]

Periodontal disease, for example, is characterized by inflammation of the gums and the surrounding tissues. Studies have shown that oxidative stress plays a key role in the development and progression of periodontal disease. The free radicals produced during the inflammatory process can cause damage to the gum tissues and lead to further inflammation, which can exacerbate the disease.

Oral cancer is another oral disease that is associated with oxidative stress. The DNA damage caused by free radicals can contribute to the development of cancerous cells in the mouth. Antioxidants can help protect against this by neutralizing free radicals and reducing the risk of DNA damage.[4]

Tooth decay is also linked to oxidative stress. The acids produced by bacteria in the mouth can erode the enamel of the teeth and lead to cavities. Antioxidants can help protect against this by neutralizing these acids and preventing damage to the teeth.[5]

Overall, oxidative stress is a key factor in the development of various oral diseases. By including antioxidant-rich foods in our diets and practicing good oral hygiene habits, we can help protect our oral health and prevent the harmful effects of oxidative stress.

4. Types of Antioxidants

Antioxidants play a crucial role in maintaining oral health by neutralizing harmful free radicals and reducing oxidative stress. There are several types of antioxidants that can be found in food and supplements, each with unique benefits for oral health.[6]

One type of antioxidant commonly found in oral health products is vitamin C. This water-soluble vitamin is known for its ability to boost the immune system, promote collagen synthesis, and reduce inflammation. In the mouth, vitamin C can help prevent gum disease by strengthening the connective tissues that hold teeth in place and protecting against the buildup of harmful bacteria.[7]

Another important antioxidant is vitamin E, which is known for its ability to reduce inflammation and protect against damage from UV radiation. In the mouth, vitamin E can help prevent oral cancer by reducing oxidative stress and promoting healthy cell growth.

Green tea is another source of antioxidants that can benefit oral health. The polyphenols found in green tea have been shown to have anti-inflammatory and anti-cancer properties, making it a powerful ally in the fight against oral disease.[7]

Resveratrol, a compound found in grapes and red wine, is another antioxidant with oral health benefits. It has been shown to reduce inflammation and improve the health of gum tissue, as well as prevent the growth of oral cancer cells.[8]

Finally, carotenoids, such as beta-carotene and lycopene, are powerful antioxidants that can be found in fruits and vegetables. These compounds have been shown to protect against oral cancer and promote overall oral health.[8]

In conclusion, there are several types of antioxidants that can benefit oral health, including vitamin C, vitamin E, green tea polyphenols, resveratrol, and carotenoids. Incorporating these antioxidants into your diet or oral health routine can help protect against oxidative stress and reduce the risk of oral disease. [8]

5. Antioxidents Used in Dentistry

5.1. Antioxidents in oral diseases

In dentistry, antioxidants are frequently utilized to treat benign conditions or premalignant lesions. Free radicals have been linked to a number of oral illnesses, including oral cancer, leukoplakia, and periodontitis, which are the most prevalent premalignant lesions. There is potential use for a broad range of antioxidants in dental treatments. For instance, eugenol is useful for toothaches, green tea is useful for leukoplakia, and ascorbic acid is useful for gingivitis.

Early prevention of oral cancer can be achieved using dietary alternatives such as beta carotene, provitamin A, vitamin A, vitamin C, vitamin E, lipoic acid, zinc, selenium, and spirulina. This is especially effective in cases of premalignant lesions, premalignant conditions, and carcinoma in situ. [9]

5.2. Tooth bleaching

The process of bleaching releases ROS. Bleaching products contain 10–40% hydrogen peroxide or 10–22% carbamide peroxide as their active components. These agents work by oxidizing organic pigments in the tooth structure by chemical means. Hydrogen peroxide may produce strong oxidizing agents called hydroxyl radicals, which are oxygen-derived free radicals, when it comes into contact with metal ions like iron ions. The hydroxyl radical serves as an oxidant during the hydrogen peroxide teeth-whitening procedure. The goal of tooth whitening is accomplished by hydroxyl radicals attacking the organic components of dentin rather than the inorganic tissue. In the mouth, carbamide peroxide initially breaks down into hydrogen peroxide, and the bleaching process is the same as previously mentioned. Better bleaching results are possible through increased hydrogen peroxide penetration into the tooth structure, which is facilitated by the heat produced by light sources. Deeper hydrogen peroxide penetration, however, can destroy tooth structures and pulp cells irreversibly by penetrating not just the enamel and dentin but also the dental pulp. [10–13]

5.3. Dental implants

The degeneration of the alveolar bone is caused by alterations in the periodontal tissue brought on by periodontal disease. Tooth loss might result from it if treatment is delayed. Currently, dental implants are a successful way to replace missing teeth. Metals, ceramics, carbons, polymers, and composites are among the biomaterials utilized to create dental implants. Shock-absorbing components that are positioned between the implant and the superstructure are the sole applications for polymer materials in implant dentistry. A Swedish surgeon who examined bone regeneration and repair as early as 1957 discovered that titanium (Ti) could successfully cling to teeth without causing repulsion and develop alongside bone. Additionally, this paved the way for the advancement of titanium dental implants. Since 1992, as contemporary ceramics have advanced, implants have been enhanced by the use of ceramic-like materials and surface treatments to promote osseointegration. The dental implants made of titanium have garnered the greatest attention.

Before the implant is placed, there are usually already some ROS present. Antioxidants neutralize reactive oxygen species (ROS) to avoid tissue damage and have a protective impact on periodontal tissue. Antioxidants now used to treat local inflammatory responses, such periodontitis, often vanish fast along with other free radicals and reactive oxygen species. The supply of antioxidants may account for the reduced therapeutic impact. Severe inflammation manifests as redness, swelling, bleeding, split wounds, and other symptoms. The majority of these antioxidants are obtainable through diets and supplements, which can be taken in addition to the previously listed diets. Tannic acids are macromolecules made up of ten surrounding gallic acid units bonded to a core glucose molecule. Tannic acids are therefore highly useful but also soluble in water and hydrolyzable. The antibacterial and antioxidative capabilities of the Agnanoparticle-modified Ti implant surface with nanoapatite/tannic acid composite coatings were emphasized by Huang et al. Tannic acid's gradual release in this study is advantageous to the dental implant's ongoing antioxidative function. Maruyama et al. used a rat model to study the effects of dentifrice containing green tea catechins. Results showed that the green tea catechins were effective in preventing periodontal inflammation by reducing gingival oxidative stress for up to 8 weeks of follow-up. [14,15]

1. Dental Restorations
2. Dental Amalgam
3. Dental Resin Composites
4. Glass-Ionomer Cement (GIC)

6. Conclusion

In conclusion, antioxidants play an important role in maintaining oral health by protecting against harmful free radicals and reducing oxidative stress. There are several types of antioxidants that can be found in food and supplements, each with unique benefits for oral health. Vitamin C, vitamin E, green tea polyphenols, resveratrol,

and carotenoids are just a few examples of the powerful antioxidants that can promote healthy teeth and gums, prevent oral cancer, and reduce inflammation. Incorporating these antioxidants into your diet or oral health routine can help improve the overall health of your mouth and reduce the risk of oral disease. [16,17]

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8. Conflict of Interest

None.

References

1. Sloberg K. Topical tretinoin therapy and oral lichen planus. *Arch Dermatol*. 1979;115(6):716–8.
2. Shah JP, Strong EW, Decosse JJ, Itri L, Sellers P. Effect of retinoids on oral leukoplakia. *Am J Surg*. 1983;146(4):466–70.
3. Willet WC, Polk BF, Underwood BA, Stampfer MJ, Pressel S, Rosner B, et al. ReIation risk of serum vitamin A and E and carotenoids to the risk of cancer. *N Engl J Med*. 1984;310(7):430–4.
4. Willet WC. Relation of serum vitamins A and E and carotenoids to the risk of cancer. *N Engl J Med*. 1984;310(7):430–4.
5. Blomhoff R, Green MH, Green JB, Berg T, Norum KR. Vitamin A metabolism: new perspectives on absorption, transport, and storage. *Physiological Reviews*. 1991;71(4):951–82.
6. Bagchi K, Puri S. Free Radicals And Antioxidants In Health And Disease. *Eastern Mediterr Health J*. 1998;4(2):350–60.
7. Percival M. Antioxidants . *Clin Nutr Insights*. 1998;10:1–4. Available from: https://acudoc.com/Antioxidants.PDF.
8. Lamson DW, Brignall MS. Antioxidants and Cancer III: Quercetin. *Altern Med Rev J Clin Ther*. 2000;5(3):196–208.
9. Singh P, Sharma P. Antioxidant basket: Do not mix apples and oranges. *Indian J Clin Biochem*. 2009;24(3):211–4.
10. Lorenzo Y, Azqueta A, Luna L, Bonilla F, Domínguez G, Collins AR, et al. The Carotenoid B-Cryptoxanthin Stimulates The Repair Of Dna Oxidation Damage In Addition To Acting As An Antioxidant In Human Cells. *Carcinogenesis*. 2009;30(2):308–14.
11. Ribeiro A, Salles PR, Silva TA, Mesquita RA. A review of the nonsurgical treatment of oral leukoplakia. *Int J Dent*. 2010;p. 186018. doi:10.1155/2010/186018.
12. Silva FMD, Marques A, Chaveiro A. Reactive Oxygen Species: A Double-Edged Sword In Reproduction. *Open Vet Sci J*. 2010;4:127–33. doi:10.2174/1874318801004010127.
13. Prakash S, Al E. Role of coenzyme Q10 as an antioxidant and bioenergizer in periodontal diseases. *Indian J Pharmacol*. 2010;42(6):334–7.
14. Chang YC, Chuang LM. The role of oxidative stress in the pathogenesis of type 2 diabetes: from molecular mechanism to clinical implication. *Am J Transl Res*. 2010;2(3):316–31.
15. Rangan U, Bulkley GB. Prospects for treatment of free radical-mediated tissue injury. *Br Med Bull*. 1993;49(3):700–18.
16. Mahan LK, Escott-Stump S. Krause's Food, Nutrition, & Diet Therapy. W.B. Saunders; 2000.
17. Antioxidant. Available from: https://en.wikipedia.org/wiki/Antioxidant.

Author biography

Arpan Manna, MSD Student https://orcid.org/0000-0001-8787-3952

Tanha Khan, Senior Lecturer https://orcid.org/0009-0001-1147-2594

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