Oxidative Stress and Oral Health

Oxidative stress is a disturbance in the systemic balance of oxidants and antioxidants. It is the result of overproduction of free radicals, including reactive oxygen species (ROS). Lifestyle factors such as poor diet, and alcohol consumption contribute to oxidative stress, as do environmental factors such as chemical pollutants and even second-hand smoke. Oxidative stress may be systemic, affecting the whole body, as well as localized, as in oral soft tissues.

Oral disease has a significant link to increased oxidative stress, and that the presence of healthy teeth contributes to decreased oxidative stress. The amelioration of oral disease may reduce the level of oxidative stress and improve the systemic condition (Gen Yano 2013). Oral cells are uniquely susceptible to free radical damage because the mucus membranes allow rapid absorption of substances across their surfaces. In oral tissues, infection from gum disease can generate oxidative stress as can alcohol, nicotine, hydrogen peroxide, and other dental procedures and substances such as hydrogen peroxide, dental cements, composite fillings, metals in restorations, dental implants etc. The increase in free radicals from oxidative stress leads to further breakdown of cell walls and oral tissue (dentalantioxidants.com)

In dentistry, although many commonly used dental materials may form free radicals but there are no major health concerns about the components of dental materials used in clinical procedures after studies have been evaluated on above-mentioned materials (Symone et al 2011).

Recent studies have shown that inflammation and oxidative stress are causative factors common to many chronic diseases, including periodontitis, atherosclerosis, diabetes, and rheumatoid arthritis. Also, gingivitis and periodontitis are contributing factors to oxidative stress and, therefore, to inflammatory disease. The body is normally under a dynamic equilibrium between free radical generation and quenching. The physiological defense systems to counteract free radicals encompass endogenous enzyme systems, such as catalase, glutathione reductase and superoxide dismutase, as well as glutathione, urate and coenzyme Q, or exogenous factors (β-carotene, vitamin C, vitamin E and selenium). All these molecules have an antioxidant effect due to their ability to transform ROS into stable and harmless compounds or by scavenging both ROS and RNS with a redox-based mechanism (Valko M 2006).

Antioxidants can counter the formation of free radicals and prevent free radical damage by donating electrons. The involvement of ROS and the antioxidant defense mechanisms in human saliva has been demonstrated in various processes of the oral cavity: healing periodontal disease, preventing oral carcinogenesis, reducing oral mucosa inflammatory reactions, and ameliorating metal-based restoration reactions (Sakagami H etal 1999).

The salivary antioxidant system has an essential anticarcinogenic role in the oral cavity, aimed at fighting ROS and reactive nitrogen species (RNS) caused by smoking, alcoholic beverages, food, carbonated drinks, dental restorations and/or various other volatile sources freely entering the oral cavity through the body's largest open gate—the mouth (Hershkovich O et al 2007). A dose-related reduction of salivary and gingival crevicular fluid superoxide dismutase levels was found in both light and heavy smokers compared to nonsmokers (Agnihotri R 2009). Where as, the study done in our country, reported that mean salivary catalase enzyme activity of betel quid chewers was significantly lower than non-betel quid chewers and mean salivary superoxide dismutase enzyme level of betel quid chewers was higher than non-betel quid chewers but

not significant among the selected Myanmar population (Kyaw-Kyaw-Myint 2015}

Scientific researches confirmed that free radicals result in the development of cancer, heart disease, cataracts and impairment of the immune system. The use of antioxidants as an adjunct alternative cancer therapy is an area of intense research. Antioxidants in the appropriate doses showed that they had relatively good impact in making the tumors more responsive towards the chemotherapy and radiological therapy. They have the ability to inhibit the growth of tumor selectively without affecting the process of normal cells. The study of antioxidants use in cancer treatment is a rapidly evolving area. The importance of antioxidants is underlined by a recent study that estimates 23% of cancer patients take antioxidants and there is a possibility that diets that are rich in antioxidants can reduce the incidence of cancer. The main drawback of antioxidants is their low biological half-life and low bioavailability at the sites reactive oxygen and nitrogen species generation (Prashanthi 2016). Antioxidants are the substances whose presence in low concentrations inhibits the rate of oxidation significantly. It is noteworthy to underlie that as for all drugs, antioxidants may give important side effects if not correctly used or in combination with other drugs. Vitamin A, E and β-carotene for instance, have been shown to have pro-oxidant effects at higher doses or under certain conditions. Therefore, the correct use of antioxidants may be useful to prevent free radical-related disorder

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