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Review Article

A Short Review on Correlation Between Nutrition and Oral Health

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Abstract

Studies have shown that maintaining uniform nutrition(N) standards is critical for promoting optimal health. According to the available research, dentists may not receive proper N instruction, whereas nutritionists and dietitians may not receive suitable training in the realm of OH. As a result, there is a need for additional programs aimed at preventing secondary diseases, such as teaching about OH and a healthy diet, fluoride prophylaxis (FP), professional exams, OH education, and periodic oral hygiene. Dental practitioners must now be well-versed not just in the ways that food and N may impact on OH but also in the ways that dental concerns may influence dietary choices and, therefore, nutritional status. As a result, the primary goal of our review paper was to concentrate on nutritional factors that may have both positive and negative impacts on OH. Thus, we conclude that there is a clear synergy between OH and N.

Keywords: OH; Dietary Pattern; N Factors; FPH; Dentists

Introduction

As we know from various past researches that, maintenance of optimal health throughout an individual's lifespan is a complex process that necessitates the continuous inclusion of N as an essential component [1]. Even every cell, organ, tissue and structure has a continuing requirement for nutrients in order to perform its specialized, dynamic, and interrelated functions.[1] Research has indicated that there exists a reciprocal and enduring correlation between oral health and nutritional status throughout an individual's lifespan. To ensure comprehensive patient care, it is imperative that dental hygienists, registered dietitians, and nutritionists possess the necessary skills to evaluate and impart fundamental knowledge to patients, as well as refer them to one another as needed [2].

There exists a correlation between an inadequate dietary pattern and various chronic ailments that are recognized to be linked with oral health. The field of dentistry plays a crucial role in the identification and diagnosis of oral diseases that are associated with dietary habits. The maintenance of uniform nutrition standards is imperative for the promotion of optimal health. As per the extant literature, it has been observed that dentists may not receive adequate nutrition education, while nutritionists and dietitians may not receive sufficient training in the domain of oral health [3]. Thus, there is a need for more programs about the prevention of secondary illnesses, including teaching about OH and a good diet, fluoride prophylaxis, professional checkups, teaching about OH, and periodic OH [4]. Henceforth, dental practitioners must be well-versed not only in the ways in which food and nutrition may affect oral health but also in the ways in which dental concerns may influence dietary choices and, hence, N status [5]. Therefore, the main purpose of our review article was to focus on N factors, which may have both positive and negative effects on OH.

Classification of foods [5]

"There are many ways of classifying foods that are as follows

On the basis of origin

- Animal Origin
- Vegetable Origin

On the basis of chemical composition

- Protein
- Fat
- Carbohydrate
- Vitamin
- Mineral

On the basis of pre-dominant function

- Body- building type = eg. Milk, meat, poultry, fish, egg, pulse, groundnut etc.
- Energy giving type = eg. Cereals, sugar, roots, tubers, fat and oil.
- Protective type = eg. Vegetables, fruits and milk.

On the basis of nutritive value

- Cerals and Millet
- Pulse (Legumes)
- Vegetables
- Nuts and Oilseeds
- Fruits
- Animal foods
- Fats and oil
- Sugar and Jaggery
- Condiments and Spices
- Miscellaneous foods"

Nutrients [6] (N)

Studies have concluded that "N are a group of chemical compounds, both organic and inorganic, that are present in the diet. Generally, the edibles that we consume provide us with approximately 50 distinct nutrients. Every nutrient has distinct physiological roles within the human body. Multiple nutrients can be found in the majority of natural foods. These may be divided into

- **Macronutirent:** These are proteins, lipids, and carbohydrates that are referred to as "proximate principles". In the typical Indian diet, each food category makes up the following percentages of total energy intake.

  Protein-7 to 15%

  Fats-10 to 30%

  Carbohydrate-65 to 80%
- **Micronutrient:** These are vitamins and minerals. They are called as micronutrients because they are required in small amounts which may vary from a fraction of a milligram to several grams".

Protein (P)

Studies have also concluded that "P are any group of complex organic macromolecules made up of one or more chains of AA and containing C, H_2, O_2, N_2, and typically sulfur and phosphorous as minor constituents [6,7]." Furthermore, studie have also concluded that "these are made up of smaller units known as AA. Studies also concluded that Essential (E) AA are those that cannot be synthesized by the human body and must be supplied via food. According to studies, "EAA are histidine, leucine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine". In addition to this, studies also revealed that "arginine, aspartic acid, serine, glutamic acid, proline, and glycine are good examples of NEAA and synthesized by human body itself" [7,8].

Protein deficiency (P.D.) and dental caries (D.C.)

Various studies have shown link between P.D. and enamle hypoplasia which leads to increase susceptibility of D.C. Another similar study concluded that, either defect in quality of matrix of enamel or alteration in salivary gland leads to initiation of D.C. Furthermore, researchers have also shown interest and concluded with their studies that, protein supplements had a favorable effect on gingival health. In contast to above studies, some researchers have also proved that, there is no direct evidence of link between D.C. and dietary supplement of protein [9].

P.D. and Periodontal tissue (P.T.)

Past studies have proved that, "mucoprotein has been E for maintenance of regular distribution of water and electrolyte in tissues". In addition, studies have also proved the relation between tooth supporting structures and protein intake. In one study, P.D. had showed negative affects on fibroblast, osteoblast and cementoblast by histologically atrophic and degenerative changes in connective tissue of gingiva and periodontal ligaments. In another similar study, authors reported that, "on introduction of foreign body into periodontal pocket in P.D, found an increase in resorption of alveolar crest, down growth of epithelial attachment and inflammatory exudate whereas after feeding protein diet the effects of deficiency was seen to be reversed" [9]. Hence, the correlation betwen periodontal health and protein status have been inconclusive and controversial because of multifactorial causation of periodontal disease. Hence, stahl., *et al*. through their study states that, "ND apparently do not initiate PDL disease, but may modify the severity and extent of lesion by altering the resistance and repair potential of affected local tissue" [9].

Protein and Oral health (O.H.) [9]

- "Adequate protein diet during pregnancy influences proper B and dental development.
- Teeth of children with PD results in crowded and rotated teeth.

- Possibility of crowded arch.
- Delayed eruption and hypoplasia of deciduous teeth.
- Small and more prone to caries in PEM child.
- 3rd molar late eruption with altered cusp pattern."

Lipids [9]

Studies concluded that "they are the group of compounds that are not of uniform composition but are related by their relative insolubility in water and their solubility in organic solvents such as ether, alcohol and chloroform". Studies also concluded that "they are classified by their chemical structures such as triglycerides, phospholipid and sterols". Additionally, researchers concluded that "over 90% of dietary fat is in the form of triglycerides; these are glycerol molecules to which one, two, or three fatty acids (FA) are attached [9].

FAT and D.C.

Studies have also proved that "dietary F and may help to prevent DC in humans. The mechanism for the same is as follows

- Coating of tooth surface with an oily substance would smear that food particles.
- F protective layer over plaque would prevent fermentable sugar substrate from being reduced to acids.
- High concentrations of FA may interfere with the growth of bacteria" [9].

Fats and O.H.

Studies have showed that, "high fat foods tend to be inhibitory towards D.C. For example, small quantities of nuts and cheese can be good between meal snack foods or even as dessert substituts for patients concerned with D.C" [9]. Furthermore, studies was done to "evaluate role of EAA in H and chronic disease, they found that, α-linolenic acid is mainly found in green leafy vegetables, flax-seed, rape-seed and walnuts have shown beneficial effects on H and disease" [10]. Another similar study have shown that, alteration of diet of foods with high in vitamin, mineral and O-3PUFA may have positive effect on PDL health" [111].

Carbohydrate

Studies have also concluded that "it is considered as 3rd major food for energy upto 4kcals per gram" [12]. Moreover, studies concluded that, "it is also E for oxidation of F, synthesis of certain NEAA" [12]. According to studies, "there are basically 3 main sources of carbohydrate i.e. strach, sugar and cellulose" [12]. Furthermore, studies concluded that "glycogen of human adult is about approximately 500 g" [12]. However, studies have also shown that "due to variety of structural carbohydrate food presence, there is a wide range of physiological effects in human body" [12].

Carbohydrate and O.H.

According to various past studies, bacteria that are capable of producing lactic acid through the digestion of sugars, specifically those that contribute to the formation of cariogenic plaque, are known to have a significant impact. The development of cariogenicity is associated with the accumulation of these bacteria in dense layers of plaque on dental surfaces, despite the fact that these same bacteria may typically be innocuous in thinner layers. Salivary production and composition are also crucial. Therefore, the buffering effect of saliva prevents acidic and alkaline extremes from damaging teeth. Additionally, studies concluded that "it contains antimicrobial compounds and is a source of minerals like Ca, PO_4, and F, which aid in reversing the acid-induced demineralization of the enamel and promote the remineralization of early lesions" [13]. Enamel that is more resistant to decay is created when fluoride is incorporated during remineralization, such as when fluoride is added to tooth paste" [13].

Vitamin

Since past history, studies have been shown conclusion that "they are the group of organic substances that have been identified as EN". Studies also concluded that "they are required by the body in extremely small amounts" [9]. They are classified as micronutrients. Studies have also concludedt that "since vitamins do not yield energy, the body may employ other nutrients" [9]. You must get them from food since the body cannot make them on its own (at least not in sufficient quantities). A healthy person's vitamin requirements are often satisfied by eating a well-balanced diet. Studies concluded that "water-soluble vitamins(WSV), such as B, C, and the B-complex, and fat-soluble vitamins(FSV), such as A, D, E, and K, make up the other group of vitamins" [9]. Studies also concluded that "each vitamin has a specific role, and a vitamin deficiency may result in a specific sickness" [12].

Vitamin deficiency (V.D.) ON O.H.

Studies have shown that, in "salivary gland (SG) the atrophy of them result from vitamin A deficiency will reduce salivary flow and increase D.C" [9]. Furthermore, studies have also shown that, its deficiency is also associated with epithelial metaplasia and hyperkeratinization [9].

Vitamin -A

It have been postulated that, "oral leukoplakia might be due to large doses of it" [9]. Additionally, during the early development, studies have shown that deficicency and high doses of vitamin A could induce cleft lip and cleft palate. Its deficency also causes decreased salivary flow, hyperkeratosis and gingival hyperplasia [9].

Vitamin-D (VD)

Studies have shown that, "1st dental change seen when it hid deficiency occurs during tooth development and calcification is hypoplasia (incomplete development of the enamel and dentin). As a result of a lack of vitamin D, the enamel calcifies poorly and may in some areas fail to form. In the dentin, spaces that represent uncalcified dentin matrix occur. The appearance of a calciotraumatic line in the dentin is the earliest sign of an acute deficiency of vitamin D" [12]. However, the physical roughness of the enamel surface

froms the characteristic pitting of teeth in rickets might dispose to the entrapment and adherence of dental plaque and sugar and thus initiate the carious process [9].

Vitamin-E

Studies have shown that "this type of deficiency is rare in human beings" [12]. Additionlly studies concluded that "if it is present it is due to congenital or malabsorption disease. Some premature infants were born with an inadequate reserve of vitamin E, which is manifest as an anemia. When there is impairment of intestinal absorption of fats, red cells are susceptible to hemolysis (liberation of hemoglobin)" [12].

Vitamin-K

Studies have proved that, "long term administration of antibiotic doses for more than a week may temporarily suppress the normal intestinal flora may the cause of this deficiency" [12]. Infants in their neonatal stage are prone to vitamin K insufficiency, primarily because of the limited reserves of prothrombin during birth and the absence of a well-established gut microbiota. It is recommended that neonates or those with heightened susceptibility receive a solitary intramuscular administration of a vitamin K formulation shortly following delivery [12].

Vitamin-B1 [6]

- Hypersensitivity of oral mucosa.
- Minute vesicles on BM, UT or on the palate.
- Erosion of OM.

Vitamin-B2 [6]

Tongue

According to many past studies, "1st and for most symptom that could be visible is glossitis. It usually begins with soreness of lip and lateral margins of the tongue" [6]. Furthermore, studies concluded that "filiform papillae (FP) become atrophic while fungiform (FFP) remain normal or become engorged and mushroom-shaped, giving the tongue a reddened coarsely granular appearance" [6]. In severe cases, researches concluded that "tongue becomes glazed and smooth due to complete atrophy of papillae and exhibits a magenta color" [6].

Lips

Various studies have shown that, "lips usually become red in colour and shiny due to desquamation of epithelium (DE)" [6]. Additionally, studies revealed that "paleness of lips, seen as maceration, ulceration and fissuring at the angles of the mouth (angular cheilitis), causing pain on mouth opening" [6]. Other than this, studies also revealed that "with time, the angular cheilitis spreads to the buccal mucosa, causing bleeding and pain" [6].

Vitamin-B3 [12].

Studies also concldued that "entire OM is fiery red and painful and salivation is profuse and entire tongue DE" [12]. Filiform papillae are the 1st to disappear, being most sensitive while fungiform papillae may become enlarged. Iin later stage, all papillae are lost. Studies have also shown that, tip and margins are affected but later on, whole of it is beefy red and swollen. In advance cases, swelling becomes so intense that indentations of teeth are found along the entire margins. Studies have also revealed that the "presence of angular stomatitis and cheilitis" [12]. Furthermore, symptoms according to many past studies includes"tenderness, pain, reddening and ulceration begin at the interdental papillae which later spread rapidly" [12]. Additionally, studies also concluded that "superimposed vincent infection involve tongue, gingiva and OM [12].

Vitamin B6 [12]

- Cheilosis, Glossitis, resembling that in niacin deficiency. The tongue is so red, it looks as if it has been scalded.
- Angular stomatitis and halitosis.
- Dental caries

VITAMIN B7 [12].

Studies have shown presence of swelling and redness of lips in biotin deficient experimental rats but no oral manifestations have been observed in humans.

Vitamin B9 [12]

Studies have shown that, "FP disappear first and FFP become prominent".[12] In severe cases, studies concluded that "they too are lost and tongue becomes smooth, slick and fiery red".[12] Furthermore, studies concluded that "severe may be seen with swelling - redness of lips and lateral margins of the tongue".[12]

Vitamin B12 [12]

Various studies have shown that, it may lead to painful, beefy red tongue, glossitis, glossodynia, small shallow ulcer resembling apthous ulcer on tongue, discomfort in wearing dentures due to weak muscle tone, nuclear abnormalities consisting of enlargement, irregularity in shape and asymmetry.

Vitamin C

- **Gingiva:** Studies have shown that, its deficiency leads to bright red hue of interdental and marginal gingiva that could be characterized by smooth, shiny swelling, resulting in the manifestation of a phenomenon commonly referred to as "scurvy bud. In the advanced stages of scurvy, the gingiva exhibits characteristics such as sponginess, ulceration, a purplish-red hue, and a tendency to hemorrhage readily. The anaerobes cause secondary infection, resulting in the development of acute necrotizing ulcerative gingivitis,

which is characterized by the appearance of punched-out interdental papillae and a foul odor. The areas that are edentulous exhibit an absence of any alterations in the mucosa.

- **Periodontium:** Studies have concluded that, its deficency leads to hemorrhage, swelling and finally destruction of the PDL, disturbance in alveolar bone formation followed by bone loss and loosening and exfoliation of teeth.
- **Teeth:** It leads to deficency, atrophy of the odontoblasts, resulting in a random irregularity instead of an organized palisaded arrangement, producing irregular or no dentin at all. The dentin generated is of the osteodentin kind. Some odontoblasts produce solitary dentin that gets entrapped in the pulp, which is frequently engorged and dilated as a result of increased blood flow. Predentin becomes hypercalcified, producing a strong basophilic staining line between dentin and pulp, and dentin production eventually stops. Finally, the odontoblasts blend together with the other pulpal cells. Even the ameloblasts are damaged and eventually atrophy. The deciduous and permanent tooth germs in scorbutic babies have some small cysts and modest hemorrhages. Furthermore, studies concluded that "severe vitamin C deficiency results in scorbutic gingivitis wghich leads to ulcerative gingivitis and rapid periodontal pocket development with tooth exfoliation" [12]. Studies in animals have shown that a "diet low in vitamin c (V C) increases susceptibility of the periodontium to chronic inflammation and acute VC deficiency increases permeability of GSE" [12].

Mineral

Studies have also shown that "more than 50 chemical elements are found in human body which are required for growth, repair and regulation of vital body functions" [12]. According to various past studies, "these can be divided into three major groups

- **Major Minerals:** These include Ca, PO_4, Na, K and Mg [9,12].
- **Trace Elements:** The aforementioned are trace elements that the human body necessitates in quantities of less than a few milligrams per day, including but not limited to iron, iodine, fluorine, zinc, copper, cobalt, chromium, manganese, molybdenum, selenium, nickel, tin, silicon, and vanadium. A significant number of additional items have been added to the inventory over the past few years [9,12].
- **Trace contaminants with no known function:** These include lead, mercury, barium, boron and aluminum [9,12].

Only a select group of mineral elements (such a Ca, PO_4 salt, iron, F, and I) are linked to clinical situations in humans that are readily recognizable. Neither the metabolic functions of the other elements nor the clinical implications of deficiency are well understood" [9,12].

Mineral deficiency affect ON O.H.

Calcium

Studies have shown that, no pathological conditions was associated with calcium deficiency has been noted in many studies. In the event of sufficient vitamin D intake, the manifestation of rickets and osteomalacia is prevented, even in the presence of reduced calcium intake. Nevertheless, there have been no reported detrimental outcomes associated with extended calcium consumption in individuals, and no advantageous effects have been demonstrated [12].

Alveolar bone loss (ABL) [12]

The hypothesis has been put forth that the prevalence of periodontal disease in India could potentially be linked to a reduced consumption of calcium in the diet. The researcher observed an increase in bone resorption during experiments conducted on beagle dogs. This phenomenon was observed as a component of widespread osteopenia, which was linked to either a deficiency in dietary calcium or an excess of dietary phosphorus. The alveolar bone exhibited the highest degree of susceptibility to resorption, with the vertebrae, ribs, and long bones following in descending order. The results of a study indicate that the daily consumption of calcium supplements for a period of 12 months can effectively reverse the demineralization of alveolar bone in humans. The aforementioned studies have indicated that the administration of calcium supplements through the diet can effectively alleviate the secondary hyperparathyroidism that arises from calcitonin production. Additionally, it has been observed that a diet lacking in calcium can lead to periodontal bone loss. According to some sources, "the occurrence of low calcium levels may be attributed to alveolar phosphorus disease, which is caused by either a deficiency in calcium or a diet that is high in phosphorus and low in calcium. However, this association was not replicated in a subsequent investigation" [12]. The available evidence does not suggest a significant association between calcium intake through diet and periodontal health or disease. Furthermore, calcium deficiency also causes periodontal bone loss according to many studies [12].

Phosphorus

Studies have also shown that, periodontal disease caused by dietary calcium deficiency or dietary phosphorus excess. In 1931, Lennox observed that white South Africans had badly rotting teeth, which he attributed to the fact that they ate foods grown in low-phosphorus soils. Osborn and Noriskin observed in 1937 that African Bantus who ate natural, unprocessed foods had a low frequency of caries because they did not eat refined foods such as white bread and white sugar. Instead, they ate bread made from unrefined wheat that was rich in phytates and organic phosphate [9].

Magnesium

Studies have proved that, it is present in enamel and dentin, but its concentration is twice in dentin than in enamel. In an experimental study, it has found that, enamel and dentin of incisor teeth will be hypoplastic because its deficiency will produce degenerative changes in ameloblast and odontoblast [9]. Further studies have shown that, its deficiency adversely affects alveolar bone formation, widening of periodontal ligament and gingival hyperplasia. Additionally, another study concluded that, "DC inhibiting abilities of Na, Ca and Mg tri-metaphosphate was found to be equally capable of inhibiting carious lesion in the occlusal sulci" [14].

Essential trace mineral

According to various past studies, "they are also called as microminerals (MM)" [12]. According tos tudies, "they are inorganic nutrients that are required by humans in extremely small amounts [from micrograms (0.001 milligram) to a few milligrams-less than 100 mg/day for humans]" [12]. Furthermore, studies concluded that "a trace M is stated to be essential for humans when it performs a vital function and is required to avoid disease. When enzyme activities are involved, and trace minerals (such as manganese, molybdenum, selenium, chromium, and cobalt) are present in typical human enzyme systems, they are considered essential" [12]. According to studies, trace elements for which dietary allowances are advised are iron, iodine, and zinc. Out of which, copper and fluorine have both been estimated to have safe and adequate intakes [12].

Role of trace elements ON O.H.

Iron(IR)

Studies have shown that, "IR deficiency leads to glossitis (inflammation of the tongue) and fissures (clefts or grooves) at the corners of the mouth. The papillae of the tongue are atrophied, thus giving the tongue a smooth, shiny, red appearance. The clinical appearance of the tongue in iron deficiency anemia resembles that in vitamin B complex deficiency. The oral mucous membranes may be atrophied and ashen gray. It is believed that oral tissues thus affected are more susceptible to carcinoma. The combination of dysphagia, koilonychia, angular stomatitis, and atrophic glossitis is called the Plummer-Vinson syndrome" [9].

Zinc

Studies have shown that, "administration of $ZnSO_4$ supplements can accelerate the process of wound healing" [9]. According to studies, "the topical application of zinc peroxide powder resulted in a quicker than anticipated reduction in soreness and a return to normalcy in the OC of patients with acute NUG" [9].

Copper

Studies have proved shown, conflicting reports on the ability of dietary supplements of copper to reduce dental caries. Some have noted no effect, whereas others have noted some caries reduction. At this time, nothing conclusive can be stated about any relationship between copper and dental caries [9].

Iodine

Studies have shown that, in "severe hypothyroidism cases, jaws become small and rate of tooth eruption is retarded. These patients suffer from deficiency of thyroid activity and have a predisposition to root resorption. On the other hand, hyperthyroid patients can conceivably develop caries rapidly because of their increased need for calories and the possible use of excessive sugars to satisfy this need" [9,12].

Selenium

Studies have shown that, "one of the commonest problems occurring in persons who ingest foods grown in soils that are rich in selenium is a higher than usual dental caries experience" [9]. Other symptoms studies conlcuded that high selenium intake are dermatitis, gastrointestinal disturbances, and abnormal fingernails. In a survey, "the teeth of children reared in seleniferous areas west of the Cascade Mountains in Oregon, it was found that these children experienced a higher incidence of caries than did children reared east of the Cascades, where there is no selenium in the soil" [13]. In animal studies, it was found that the "ingestion of selenium during the period of active tooth development increased the incidence of caries significantly, and that the increase was proportional to the amount of selenium in the diet of the animals" [12]. Additionally, studies also concluded that "it is speculated that incorporation of selenium during formation of teeth changes the protein components of the enamel and makes it more prone to DC" [13]. However, the threshold value of intake below which selenium does not increase caries is not known [9].

Molybdenum

According to an epidemiological study conducted in "Hungary, the high molybdenum content of the water was responsible for the lower caries incidence among children born and raised in the town of Devavanya when compared to the incidence in children from a neighboring town, Gyoma, which had only traces of molybdenum in its water supplies" [9]. Hadji Markos reviewed the data for this study and said that the findings were doubtful due to inadequate data. In another study conducted in New Zealand found that, the number of caries was found to be lower in natives of Napier. Thus concluded that, increased amount of molybdenum was responsible for 21 to 57% fewer caries in the Napier children [9,14].

Vanadium and strontium

Vanadium and D.C.

According to Tank and Storvick's epidemiological investigations, "there seems to be an inverse relationship between the vanadium content of water sources and DC; that is, larger concentrations of vanadium result in a lower quantity of caries. The number of cavities in hamsters and rats was reduced when vanadium was

supplied orally or intravenously. Others, however, have experienced the opposite effects" [9].

Strontium and D.C.

Researchers found in their studies that Texans had a higher strontium content in their teeth. Increases in fluorine and strontium in tooth enamel were found to be linked to a decreased incidence of caries in the teeth studied by another group of researchers. In a study comparing the fluorine and strontium levels in the enamel of teeth from natives of New England and South Carolina, researchers found that the New England group (with a high number of caries) had fluorine levels of 82 ppm and strontium levels of 104 ppm, while the South Carolina group (with a low number of caries) had fluorine levels of 125 ppm and strontium levels of 184 ppm. It demonstrates that high levels of fluorine and strontium may cooperate to increase enamel's resistance to breakdown [9].

Fluoride on O.H.

Churchill compared the samples with the fluoride analyses of water from 30 areas in which tooth enamel was normal. The results confirmed the hypothesis that there was a correlation between high fluoride levels in water supplies and endemic mottled tooth enamel. This hypothesis was subsequently tested and confirmed in rats, which developed mottled incisors after ingesting excess fluorides. Also, young children who drank from an unfluoridated water supply did not develop mottled enamel even though older brothers and sisters might have shown this defect, because the latter had drunk from fluoridated waters while their teeth were calcifying [9].

According to studies, "about 66% of the greatest reduction in P and T DC came from PEF, while in smooth surfaces, this effect was reduced to 25%" [15]. In approximal surfaces, studies concluded that the "reduction was due half to pre- and half to post-eruptive fluoride(PEF)" [12]. Studies also concluded that "PEF became more important with decreasing severity of DC. Thus, assuming that the majority of such populations will benefit most from the use of topical F" [9]. However, studies also concluded that "in HR groups, supplementation of PEF can still be of major importance" [15].

Studies also concluded that "F acts to reduce DC by

- Stabilizing the apatite lattice so that it has a more perfect structure, which increases its resistance to acid demineralization.
- Prompting remineralization of carious lesions.
- Lessening bacterial acid formation and plaque formation" [9].

Water intake

Studies alos concluded that "like the other soft tissues in the body, the mucosa of the oral cavity has high water content (70 to 80%)" [9]. Therefore any systemic factors that produce either general dehydration or edema of tissues will similarly cause shrinkage or swelling of the oral tissues. As mentioned previously, "patients who ingest high-salt diets and retain the sodium will accumulate body water" [14]. Conversely, studies concluded that "patients on a low-carbohydrate, high-fat diet or a high-protein diet for rapid loss of weight will tend to lose large amounts of water from the excessive oxidation of body fat" [15]. Patients wearing full upper dentures who lose large amounts of body water will experience denture looseness and the accompanying discomforts. On the other hand, studies concluded that "denture wearers who retain water will tend to have pressure-induced sore spots on the underlying swollen M" [16]. Dehydration can cause a decrease in salivary flow, which tends to promote xerostomia (dry mouth). A common clinical oral problem associated with xerostomia is the lack of lubrication of mucosal surfaces. Studies alos concluded that "the roof of the mouth and Tongue develop a burning sensation and the corners of the mouth become macerated and infected owing to a tendency to moisten them by licking" [9]. Also, xerostomia promotes increased dental plaque formation and the consequences of gingival irritation and more rapid dental caries production [9].

Conclusion

According to various past studies, nutrition plays a critical role in preserving the integrity and proper function of the OC. As the OC reflects the systemic health status, most of the disease manifestations, including nutritional disorders, occur there. Therefore, it is important on the part of the dentist to aid in the early diagnosis, intervention, and prevention of these disorders. Hence, we conclude that there is a definite synergy between OH and N.

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